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ABSTRACT

Intended for both novice and experienced users, this guide is designed to inform and entertain the reader in unravelling the jargon surrounding video equipment and in following carefully delineated procedures for its use. Chapters include "Exploring the Video Universe," "A Grand Tour of Video Technology," "The Video System," "The Video Camera," "The VTR," "All about Videotape," "Making the Right Connections," "TV Monitors and Video Projectors," "VTR Interchangeability," "Connecting and Operating the VTR," "Basic Videocassette Systems," "The Video Portapak," "ENG and Portable Videocassette Systems," "Maintenance and Troubleshooting," and "Setting Goals/Purchasing Equipment." Diagrams, a glossary of terms, and appendices on information sources are provided. (MER)

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THE VIDEO GUIDE

Second Edition

by Charles Bensinger

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Illustrated by David McCutchen

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to the physical realization
of *The Video Guide.*

Cover concept by Charles Bensinger

Video being such a visual subject, it seemed desirable to utilize as much visual material as possible. Numerous individuals and video companies assisted generously towards this effort. Their contributions have made possible a rich, varied and very comprehensive publication.

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Foreword

Evolution has certainly changed us—from a simple, hardy creature who worked the soil for survival, to a complex and tense organism whose machines now supply the daily bread and transmute the very essense of an entire planet. The machinery of this earthly transmutation is technology, the high priest of steel and electrons, which has somehow become more than a master. It has become a religion to many, whose icon, **TELEVISION**, transmits electrical pleasure images, mind-altering sounds and dispenses pseudo-psychic nourishment.

Television generated a phenomenon called **VIDEO** which has become the visual walkie-talkie of 20th Century Civilization. Because the industrial/electronic revolution wrenched askew our traditional sense of community, video has a great potential as a primary means of communication which could be used to restore our lost sense of community and open channels of individual, national and international dialog.

But effective electronic visual/sound communication requires skillful use of the communications tools. Video presents an enormously exciting potential, but its seeming complexity often hinders the user's creativity. **The Video Guide** exists to shatter the fear of the technical equipment and replace this fear with confidence and self-assurance.

Our first task is to make some sense out of the sheer amount of video equipment that has suddenly appeared. Not only has the number of possible choices of cameras, VTRs, VCRs and monitors increased dramatically, but whole new systems and devices have been created and proliferated.

If you're new to video, **The Video Guide** will unravel much of the mystery and jargon surrounding video equipment and proceed with careful step-by-step procedures to explicitely describe what you need, how everything plugs together, what buttons to push, and what it all is supposed to do. You can let the book do the thinking while your hands do the plugging.

The Video Guide has much to offer the experienced user as well, as he/she might not have kept up the latest state-of-the-art cameras and VTR systems.

The Video Guide also takes the next step—a look into the relationship of the man or the woman to the technology itself. The intriguing idea of the machine as an entity capable of responding to the personality and attitude of the user is explored and examined with the purpose of enabling you as a video user to have a more successful and productive video experience.

The video experience, as uniquely gained through **The Video Guide**, is not merely designed to inform, but also to entertain and perhaps even enlighten as well. It is hoped **The Video Guide** will serve as a useful and faithful companion during the evolution of your own Video Adventure.

Charles Bensinger
Author

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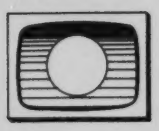

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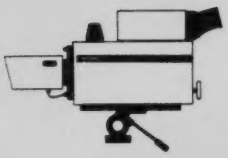

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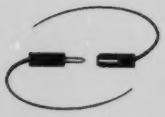

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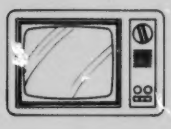

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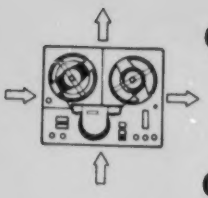

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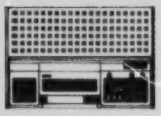

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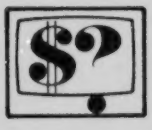

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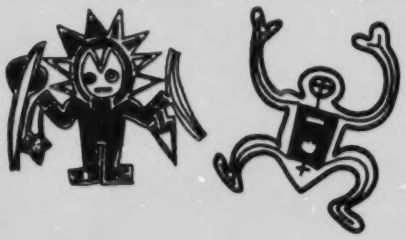
Chapter 1
Exploring The Video Universe



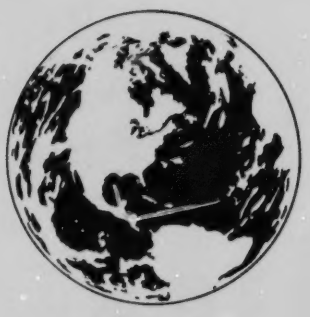
From Caves to CRT's

Humanity, fascinated by its ability to render and preserve images of life, at first fashioned spectacular visuals on cold cave walls. As emerging civilizations coalesced in misty green jungles and hard sprawling deserts, they told their tales of gods, conquests and daily ritual on massive stone pyramids and sacred temples. Exquisite frozen views of human life in ancient and later societies appeared almost alive on valued articles of wood, gold, silver, bronze, copper, clay and bone. Humanity's images next emerged colorfully and effusively from the ubiquitous medium of paper and later became electronically honed into patterned blobs of pure energy and wavelengths which fly through the intricate workings of solid state circuitry and are displayed on the familiar television set or CATHODE RAY TUBE (CRT).

We have transformed our image making tools from stone and charcoal to light and energy. We have emerged from the darkness of prehistoric caves to harness light and energy on a technological level, although not yet commonly on a metaphysical level. By moving energy through air, wires and circuits, we can communicate abstract thoughts across a planet and strongly influence whole societies. Television can cause millions of individuals to laugh or cry and to believe or disbelieve. It's only a question of how one uses the image-making tools.

And just how are these image-making tools used? The majority of the people in the United States and the Western World in general have had most of their knowledge of life and society delivered to their minds by the great god TELEVISION. A whole generation has now been weaned on the *Big Boob Tube in the Sky*, and many lives consciously or unconsciously revolve around the one-eyed media god that sits piously on its sacred altar in the living room temple.

Visual and sound images can define to a great extent how we perceive our world, our fellow humans, other living creatures and our environment; the medium of television is having an enormously powerful effect on our own personal visions of life. Sadly, TV programmers relentlessly seek out violence, contention and sensationalism to be used as the basic content of most programming. If audiences willingly and continually absorb this kind of information, their personal view of life inevitably will become one pervaded with violence, contention and sensationalism. As we think, so will we act.

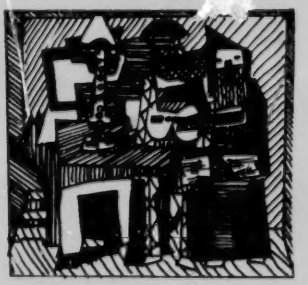


The TV Potential

TV technology provides us with a daily satellite view of our small blue and white planet from thousands of miles in space. Television takes us nearly anywhere in our world or to another world LIVE in seconds. It has begun to make us aware of the possibility of one day perceiving our planet as an interdependent community where we are all really parts of the same whole.

Television has given us a near total faith in technology, that technology can do anything and everything. However, with that faith now severely shaken for many persons, television could begin to seek out, study, and show real and possible solutions to pressing world problems. Programmers could turn their cameras toward positive, constructive and hopeful events and endeavors. Inevitably, the minds of those who watch such programming would begin to view life in a more positive light.

We could create a TV program called "Alternatives for Earth," which would take us each week to individuals as well as groups who have developed creative and beneficial projects, life styles, energy systems, devices and attitudes, from which the nation and the world could benefit. Imagine a live two-way New Year's Day satellite special where China, Russia, France, Viet Nam, Angola, Canada, and the USA would share methods of energy conservation or national health care systems. Technologically, it's possible right now.



Few people doubt the severity of the problems facing our civilization. Most of these problems are due to ignorance and lack of communication between people and nations. Television has truly made us a global community in the physical sense by interconnecting even the most remote villages by means of communication satellites. Our next evolutionary step must be the *human interconnection* when physical differences and boundaries become unimportant, and individuals of all nations become harmonious citizens of one globe—the planet Earth!

The Television Conspiracy

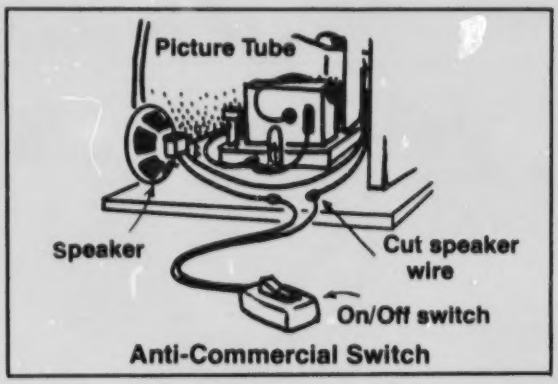
Consider this scenario. If one person, a group of persons or a government really wanted to control a society without violence or armed force, how could they do it? The conspiring groups might neutralize people's minds and bodies by drugging them into a constant lethargic and complacent state of mind so they would have no time to *think about what was happening to them!*

It's easy. First, convince people they must work at least 8 hours a day, come home, and feed and entertain a family. Next, seduce the tired family mentally. Allow them to sit down, drink a beer and *watch television*. Make sure there are no programs shown that cause anyone to *think!* Soon it's 10 p.m. and time to sleep. Meanwhile, the masses have offered absolutely no mental resistance to all those "you need a new car, a motor home, a big suburban house" ads. They will begin to believe that their own personal happiness is entirely dependent on all those horrible chemical food and drug products that the tube beseeches them nightly to purchase. Soon, everyone's convinced that the suburban house and the new car and all the other *things* they see on the tube are the reason why they are all going to work at 8 a.m. again tomorrow morning, and the morning after, and the morning after, and the morning after...

An individual who can't think isn't very dangerous and won't be tempted to upset the American Apple Pie Cart. Is this really American Television? Has *1984* been here all the time but in disguise?

Resisting the Tube

Until Broadcast Television begins to demonstrate a "higher consciousness," we can take positive steps to minimize personal psychic damage. An excellent antidote that I've discovered is to pack away my TV set for 6 weeks or longer, making it impossible to watch anything on television. After the initial withdrawal symptoms subside, you slowly become aware of the wilderness areas of your mind—a truly startling phenomenon indeed for most people! Then, suddenly you have all this *free time* that may even tempt you to begin *reading* again or taking Yoga lessons. Amazing! You soon wonder how you found time to watch TV at all. But more important, you begin to *think* and be creative again. Try it, you'll like it!



Anti-Commercial Switch

The Greatness of Television

Undeniably, Broadcast Television has produced moments of triumph. Excellent special programs have been created dealing with national water-quality problems, the Washington bureaucracies, the IRS, the dangers of nuclear power, criminal conspiracies and other important subjects. Great cultural and historical events have been broadcast and television has served as a forum for discussion of important political issues. Superbly entertaining and enlightening dramas such as *Roots* or *The Adams Chronicles*, when presented on television, have performed a valuable service to society.

During a major world event such as a moon landing, we witness the potential of the only medium which can command the eyes of the billions of our fellow planetary inhabitants in just minutes! Occasionally, the medium of television really does bring us all together.

BROADCAST TV—The Inheritance

NBC-ABC-CBS gave us all our start. They set the standards for the technical aspects of TV production. Let's call it *slickness*, a term which describes the fast-paced, perfectly-edited visual and audio components of the traditional TV program. We may or may not include program *content*, in our concept of slickness. Individuals who turn to other forms of TV often do so in hopes of finding something beyond this characteristic Hollywood and New York slickness.

Individuals who do try to emulate this typical Hollywood technical style soon discover that it is hard to duplicate with a single small Sony VIDEO (television equipment) system. So, video producers with limited technical equipment and funds must try to have strong content and creativity in their programs to compensate for the technical limitations of their equipment.

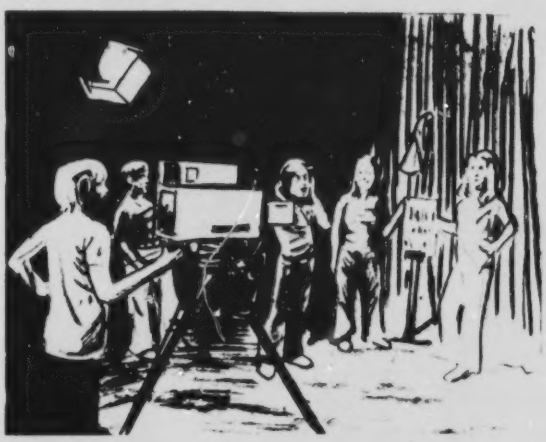
Another comparison would be to liken the TV networks (NBC, CBS, ABC) to NASA with all its space capsules, simulators, computers, rocket ships, brilliant technicians, and so on, while the enthusiastic individual producer has only his home-made 3-foot rocket. The two just are not in the same technical category.

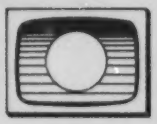
Nevertheless, under ideal conditions, a well-tuned late-model portable video unit can produce a good visual product capable of being transferred to television broadcasting equipment, and the average home TV viewer will not notice the difference. In spite of the many complex technical factors to be considered, this type of individual programming is being done regularly, especially by the Public Broadcasting System (PBS).

We all know what Broadcast TV brings to the screen. The technology behind the scenes includes massive VIDEOTAPE RECORDERS (VTRs) costing $160,000 *each* and equal in size to two refrigerators! Millions of dollars are invested in peripheral equipment that inputs or outputs to the VTRs. These extremely sophisticated machines are manned by equally sophisticated teams of technicians who precisely tune and monitor a myriad of electronic vital signs that constantly flow from within the equipment's electronic innards. The control center in a big TV network broadcasting studio is really dazzling, and the images that appear on the studio TV screens are so real, colorful and vivid, that it is actually shocking to persons who have seen nothing but their own TV sets.

Only television broadcasters can afford the really big video equipment, but that great expense is also their big limitation. They are bound by unions, omnipresent commercial considerations, huge bureaucracies, and they are the psychological victims of Neilsen ratings, prospective sponsors and intra-industry competition.

The TV networks have little freedom to move. They can't try radically new programming concepts, because who will buy them? They can't experiment with space and time because it's impossible to fit an 8-minute or 65-minute program into the *traditional* format. They can't use the kids on the block as actors, because the children can't act very well; and besides, they are nonunion.





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EDUCATIONAL/INDUSTRIAL SUB-NETWORKS

SUB-NETWORKS are composed of several individuals or groups, sometimes separated geographically, who watch a common type of specialized live or videotaped TV programming. Usually the programming is of a noncommercial, nonbroadcast nature. Examples are nurses in a hospital watching "patient care" tapes, Datsun workers learning "how to tune a carburetor" by videotape, students of Transcendental Meditation viewing a video lecture on "The Science of Creative Intelligence," and citizens of a remote village in Canada or Alaska taking adult education classes on TV which are beamed in by satellite from a distant source of origination.

Education by TV

The potential for education by TV is unlimited. Advantages of using television for training are:

A. The world's best expert(s) can be secured to talk about the subject.
B. The expert's presentation can be rehearsed until perfect and then taped, eliminating human error.
C. The expert is always available on the tape—permanently, 24 hours a day. The tape never gets tired or makes mistakes.
D. Many copies of the program can be made.
E. The program can be shot on location anywhere in the world if the budget permits. The world becomes the classroom.
F. A taped program can be reused many times.
G. Films, slides, graphics and outside videotaped material can be integrated into the program, providing a flexibility not possible in the live classroom situation.
H. The program can be edited and time, space and distance manipulated to create the best effect.
I. The program can be made available on easy-to-use standardized videocassette formats which can be displayed on ordinary TV sets.
J. Videocassettes can be played for large groups through a video projector or played privately by one person on a small portable TV set.
K. The program can be repeated many times, stopped or advanced forward for the individual student's needs.
L. The overall cost of videocassette learning tapes is usually very cost-efficient, especially if produced on a large scale.

NOTE: There are many kinds of learning experiences that are NOT well suited to videotape presentations. It may be less expensive, simpler and more effective to use audiotape recordings, slide or filmstrip presentations or good printed materials to express a concept through media.

One of the finest examples of general Educational TV media is Jacob Bronowski's "Ascent of Man" series, produced by the British Broadcasting Corporation (BBC) and shown on American PBS. Of course, that series had a considerable budget, but all components of the show were strong. The script, Bronowski's presentation, the visual documentation, sight and sound effects and continuity of content were all superbly thought out and executed with a high degree of professional excellence.

That's what can be done with millions of dollars and highly-skilled technical personnel. On a much lesser scale, but often equally effective, are all the educational-institutional training and informational videotapes made by individuals and groups every year for a myriad of purposes—i.e., tapes for firemen, policemen, students, insurance salespersons, Army, Navy, government, accountants, lawyers, psychologists, masseuses, welders, doctors, realtors, dentists, and so on. The list is endless.

It's this middle range educational/institutional category that can afford the comparatively low-to-moderate-cost television equipment. Instead of spending millions of dollars like the TV broadcasters, the high school, hospital or insurance company can spend from $2,000 to $5,000 for playback-only equipment; from $5,000 to $30,000 for a black-and-white production studio; and from $10,000 to $80,000 for a color-production studio.

A typical industrial video system design will locate the main TV production studio in the home office and have playback-only equipment at branch offices. Large colleges and universities may invest $300,000 to $1,000,000 or more in elaborate color studios where complex educational tapes can be made and played directly into classrooms throughout the campus.

THE VIDEO INDUSTRY

The educational/industrial sector purchases most of the nonbroadcast video equipment manufactured by Sony, Panasonic and JVC (Japanese Victor Corporation). This equipment includes portable video systems, editing VTRs, and videocassette units. An entire electronic industry grossing hundreds of millions of dollars annually, thrives on servicing and selling all kinds of television equipment to this market.

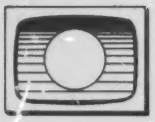
There is another interesting comparison of Japanese and American technology in examining this particular electronic marketplace. Whereas American technicians originally invented and developed the process of videotape recording in 1953, it took the Japanese to refine it and manufacture a system sufficiently sophisticated, dependable and economically viable to appeal to the broad popular educational/industrial marketplace.

American manufacturers have tried several times to duplicate the low-cost Japanese video products but have been consistently unsuccessful. Failures include the AVCO CARTRIVISION and the CBS EVR (Electronic Video Recording) systems. Instead, American manufacturers have had to confine themselves to the large super-sophisticated high-cost VTRs used in the broadcast master-production studios where American Technology is still king.

But on the streets, where the action is, the Japanese reign virtually unchallenged. They also are making substantial inroads into other areas of broadcasting, primarily due to the rapid improvement of the VIDEOCASSETTE (self-contained videotape) format. By 1975, Japanese videocassette systems were in regular use by all TV broadcasting network companies for in-the-field news, program editing, and over-the-air broadcasting.

THE NARROWING OF THE GAP

Initially, a great gap existed between the so-called SMALL-FORMAT Japanese video equipment with its ¼-inch, ½-inch, ¾-inch and 1-inch videotape widths and the big-time network broadcaster's LARGE-FORMAT 2-inch tape width machines. Although the difference in tape width means that the formats are not physically interchangeable, the real division has more to do with the quality, or lack of quality, of the electronic signals put out by the videotape recorder. Historically, the 2-inch tape width has always been the broadcast videotape format and 1-inch, ¾-inch, ½-inch and ¼-inch widths have been the nonbroadcast videotape formats. Intermixing of the 2-inch width and any other format was virtually nonexistent prior to 1975.



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The video situation could be likened to the distinction between the super-8 format independent producer/filmmaker and the 35 mm format-feature movie industry. Although both entities make films, the two formats and associated personnel are very isolated from each other and intermix only on extremely rare occasions.

The same kind of split and isolation is inherent in television also and will always exist between the big network TV factories and the small independent video producers. Although there are usually profound philosophical differences between the two entities, the technical capabilities of the large-format and small-format equipment now has become substantially blurred. The large 2-inch tape video equipment used by the studios has not come down in price so independents could afford it. Instead, two very important technological events took place in 1974 and 1975 that changed forever the hardware relationship of independents and broadcasters.

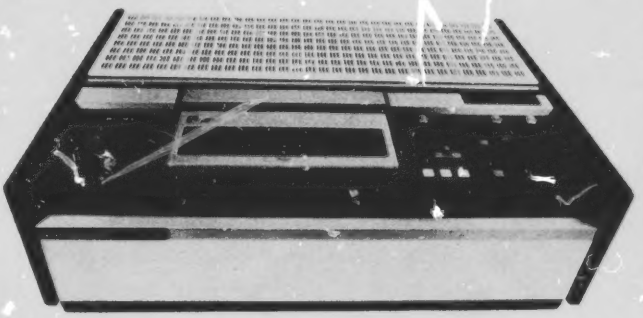
The Breakthroughs

The two most important breakthroughs in recent video technology were:

CVS 504B Time Base Corrector

1. The development of the TIME BASE CORRECTOR—an American analog/digital computer processing device, about the size of a portable electric typewriter, that rebuilds and fixes up the abnormalities and errors in the electronic signal of low-cost, small-format videotape recorders.

2. The development of the second generation, highly improved ¾-inch videocassette recording, editing and portable machines by Sony Corporation and later by JVC (Japanese Victor Corporation).



Sony VO-2600 Videocassette Recorder

The net result of these two revolutionary technical breakthroughs, one American and one Japanese, has been to technically throw open the doors of TV broadcasting to anyone who can afford to rent, buy, borrow or barter good basic small-format video equipment. This means the technical argument of "no, you can't play your portapak stuff over our broadcast system because it's not stable enough" is no longer valid.

A Word of Caution—"It's not all that easy!"

Even though it's possible on a technical level to play small format tapes on Broadcast TV, this doesn't mean the process is a simple one. The usual bureaucracies have to be dealt with; possible union problems settled; your original tapes must be excellent technically, so they will work with the Time Base Corrector, and the program's content must be of interest to the TV station's audience. You also may need to edit your tapes on the studio's 2-inch video equipment. All this will cost someone time and money. If your project is good enough, the TV station may be willing to provide free editing time and technical personnel.

Fortunately, as lower cost video technology improves, the equipment distinctions between the broadcasting networks and the independent producer tend to blur. This creates increasing opportunities for broadcast TV to decentralize, to become more flexible and varied, and hopefully to allow more alternative programming to flow through the broadcast and nonbroadcast programming systems.

CABLE TV—A Mixed Blessing

Back in the early seventies, when large conglomerates like Teleprompter Inc. were purchasing all the small local Cable TV companies they could find, many wild claims were being made. "30 channels in every home! Special access channels for the public, schools, government and industry! The housewife can do all her shopping from her TV set at home! Computer terminals, 2-way medical care, electronic newspapers, first-run movies—all possible with Cable TV!"

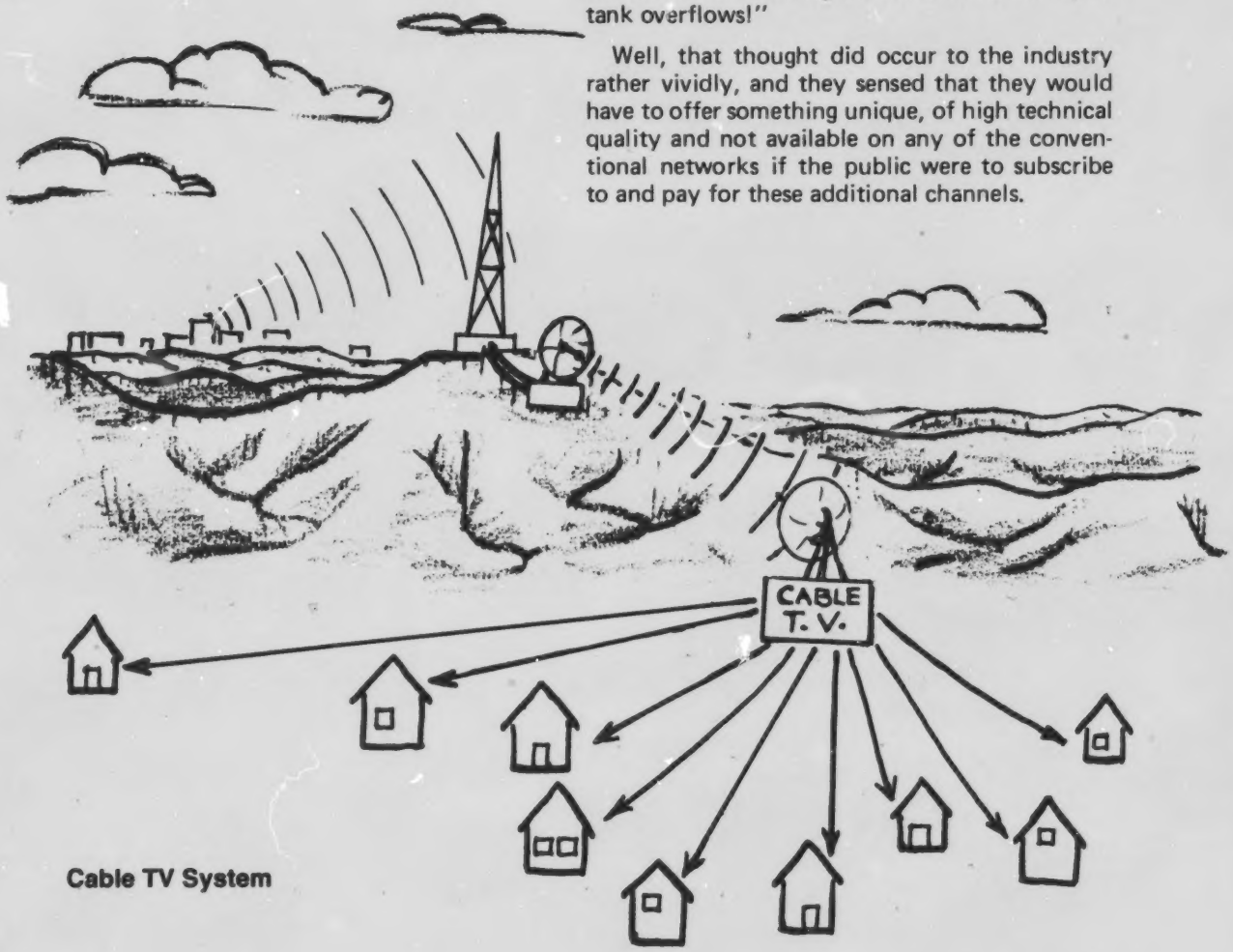
No doubt about it, all this is absolutely possible today. But unfortunately, few people worked out the economic realities of all the blue-sky thinking. Then the Second Great American Depression set in and quashed the hopes of many an eager citizen group and visionary Cable TV operator as well.

Is Cable TV Dead?

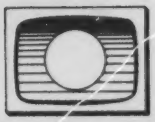
Hardly. The big conglomerates quickly revised some of their goals, tried to lower the viewer's public-service expectations of them, closed many local program production studios, and quietly retrenched themselves into selling more subscriptions (home cable hookups) and getting Pay TV off the ground and into a satellite TV program distribution system.

Cable TV works by bringing in distant TV stations by means of master antennas and channeling a large number of broadcast stations into the single coaxial cable that leads to the home. Upwards of 30 different channels can be squeezed into the present cable and as many as 80 to 100 channels through the use of optical fibers or lasers. But, "who needs 80 TV channels," you might ask, or, "the 12 I have now are garbage, and my kids' minds are being ruined! Adding 50 more channels is like flushing the toilet while the septic tank overflows!"

Well, that thought did occur to the industry rather vividly, and they sensed that they would have to offer something unique, of high technical quality and not available on any of the conventional networks if the public were to subscribe to and pay for these additional channels.



Cable TV System



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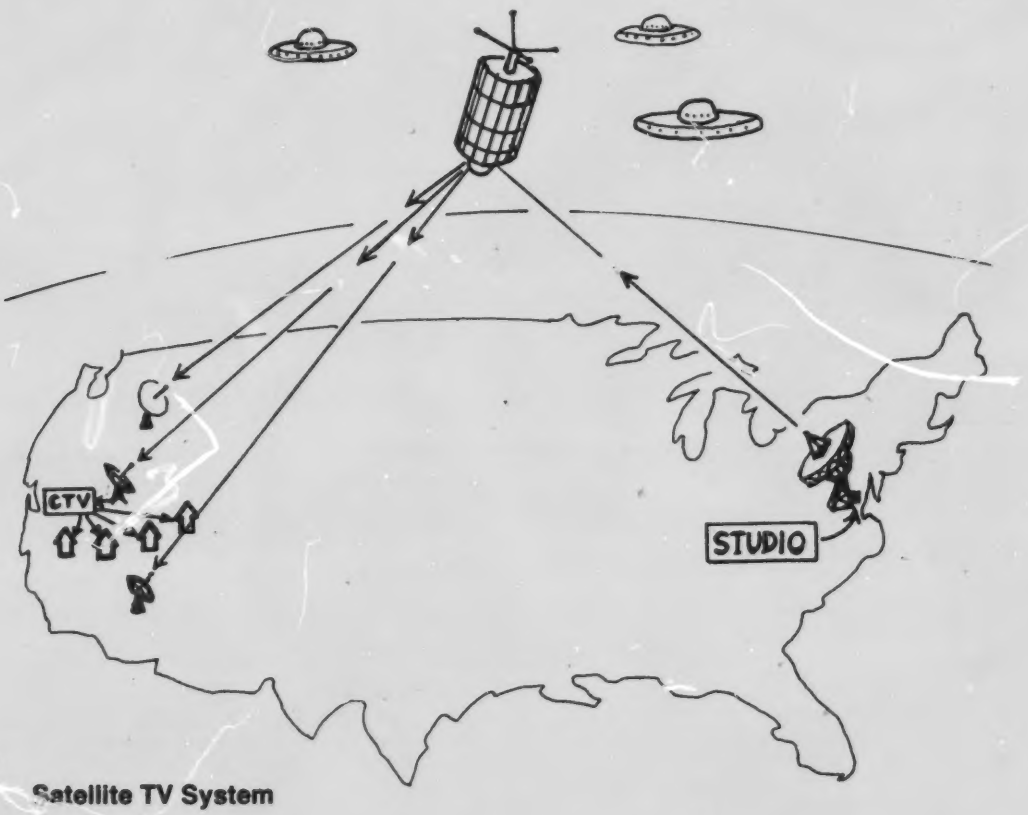
"Pay-As-You-Go"—Pay TV

The CABLE TV (CTV) industry soon wired up as many homes as possible and began to move into major cities, where the competition was fierce for antenna-received TV stations. Most cable companies added at least one PAY TV channel where (for a $5 to $12 per-month extra fee plus a $25 deposit) you could get popular movies, sports highlights and other special entertainment on your TV set without commercials. This worried both the TV broadcasters and consumer groups who feared that eventually all of the best programming would be siphoned off by Pay TV and become so expensive that only those willing to spend $18 to $25 per month could enjoy the top TV programs.

The latest development in Pay TV now finds several satellites in orbit transmitting movies and other programming from one or more central sources to relatively inexpensive earth receiving stations owned by your local conglomerate Cable TV company. The CTV Station then transmits the signals through your cable system on the Pay TV channels to your home. Since only a few large companies own most of the Cable TV systems in the country, the satellite Pay TV network is large and certainly ranks next in size to the traditional Broadcast TV network.

The disadvantage of the satellite system is the loss of local control over Pay TV programming. Communities cannot determine what kinds of programming would best fit their needs. Up to now, however, there has never been any control over Pay TV because the FCC (Federal Communications Commission) has never drawn up any regulations for this kind of programming. The advantages and potential of this system lie in the facts that it does not have to show commercials (Hallelujah!), and it is not yet bogged down by unions, traditional TV station bureaucracies and rigid format policies. Pay TV definitely represents an opportunity for independent and educational/industrial producers to market their programs to a national audience and get paid for it. So check it out. *See Cable TV Appendix.*

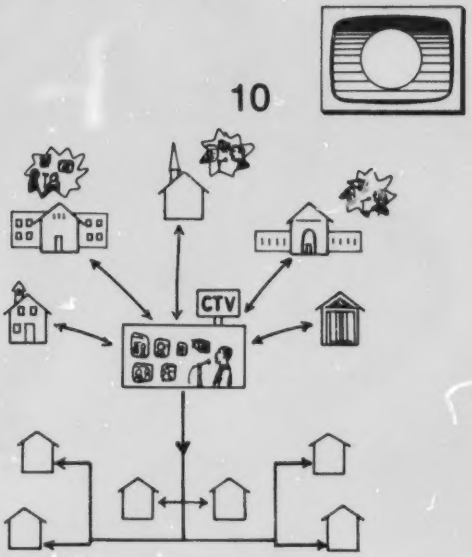


Satellite TV System

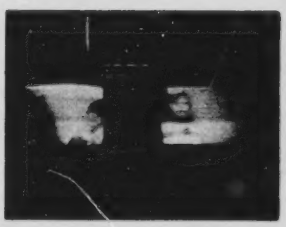
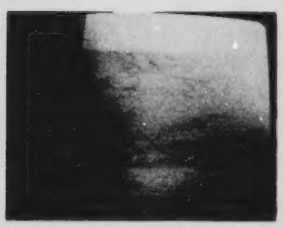
2-Way Cable TV

In spite of the discouraging economics of the times, several communities and groups have plunged ahead with experimental 2-way Cable TV concepts. One successful system has been operating in the City of Irvine, California, since 1975. Called *Irvine Interactive Video*: a series of 2-way video and audio terminals have been established at 14 key locations in the local community. Sites include nearly all the public schools, the library, City Hall and the University of California's Irvine Campus. Professors and students hold regular 2-way classes and conferences 5 days a week and the City Council has conducted 2-way discussions with citizen's groups located at the schools.

Since 95% of Irvine residents subscribe to the cable system, the video and audio dialog is fed into the cable system so residents can view what's happening in their schools and government chambers.



Each terminal functions with only $1,800 worth of video equipment and is manned primarily by 10-year-old students. A system such as this could do much toward bringing a community together, consolidating community services, making government more responsible to the public, and reducing expensive transportation.

What Ever Happened to Public Access?

During the *Days of Great Expectations of Cable TV* (1969-1973), one claim really struck a responsive cord with many public-spirited citizens. The Cable TV companies touted a PUBLIC ACCESS CHANNEL where any citizen or local group could get a small amount of free TV production time to communicate to his fellow citizens as long as some clothes were kept on and the program was in good taste. The Cable TV company would provide a free studio for the community's use, and the people in the community could now use television to really keep in touch with each other. Great idea—lots of potential! Local citizen's groups loved the idea, and media-interested people of all ages instantly formed PUBLIC ACCESS GROUPS like *The Santa Cruz Community Cable TV Project* and the *Los Angeles Public Access Project* to facilitate each community's use of local television programming. For a while it looked like a new age of human communication had dawned.

Then, for financial reasons the cable companies abruptly pulled the plug. Now many local groups had no distribution systems and no reason to exist. The FCC softened the Public Access Cable TV requirements and left the future of PA shrouded in doubt. Any Public Access activity now would have to be accomplished on a local level.

The next step found the Cable TV companies trying to bypass Public Access, which would only cost them money, and move directly into the big money of Pay TV. Most traditional firms are in business to make a profit and from this point of view, eliminating Public Access was a good business decision for the Cable TV companies. However, the public raised the issue that all media has a responsibility to serve the interests of citizens and the local community first, contending that certain services such as Public Access should be considered as an *expense* and part of the cost of doing business in the local community.

And so the battle continues to rage among local Public Access groups, city councils, Cable TV companies and the FCC. Public Access will work if a source of regular funding is set aside by the local Cable TV company and/or the city and county it serves. Sometimes, the Cable TV company will provide a free studio, equipment and offices, and the city or a funding agency will provide production salaries and operating budgets. Any kind of a successful arrangement usually requires much research and several years of political lobbying by a few very dedicated volunteer visionaries who have been willing to work long hours for several years to get it all started.

Someday in the great REAL TV HALL OF FAME, a monument should be erected to all the incredibly dedicated, hard working, underfed, underpaid and burned out video visionaries who have committed several years of their lives to the concept that COMMUNITY TV might be born and show the world the true human potential of television and video.

ALTERNATIVE TV OR VIDEO: "The Media the Media Doesn't Know About."

The Video Universe includes people as well as equipment. After all, the hardware can do nothing without people to operate it. Computers may be able to run themselves, but cameras and videotape recorders will always require human minds and eyes to point them in the right direction and to make the decision of what and when to shoot. Interestingly, the word VIDEO derives from the latin verb *videre*, meaning "to see" or the act of seeing.

Broadcast TV, the *BIG MOTHER* of us all, has indeed produced a generation of enthusiastic video children, many possessing amazing personal imagination, vision and unflagging economic tenacity. As a natural evolution, the video children then invented ALTERNATIVE TV or VIDEO.

The term ALTERNATIVE TV means just that—a different form of seeing through television. Unfortunately, since the national networks do not yet show Alternative TV programs on a regular basis, the public knows nothing about the existence of such things. But talking about Alternative TV requires us to distinguish between TELEVISION and VIDEO.

There are both technical and philosophical differences implied by these terms. The word TELEVISION generally refers to the traditional Broadcast TV network structures—their programming, policies and big expensive equipment. They use the best and most sophisticated technology money can buy. The term VIDEO is philosophically used to describe the multitude of small low-budget independent video groups, public access groups, individual persons, producers and schools which don't have the large budgets of the broadcasters and so must utilize the low-cost black-and-white video equipment, such as the legendary Sony or Panasonic PORTAPAKS (small portable video systems) and an editor VTR or two.

The phenomenon of the low-cost TV equipment and its use to produce an alternative type of programming soon became known as VIDEO. Far too often budgets were so limited and the medium was so new, that the technical quality of programs suffered. However, strong and unusually relevant and intimate content often compensated for the technical deficiencies. Powerful social documentaries came to be a popular form of Video activity.

In strictly technical terms, the word VIDEO also refers to the actual electronic signal emitted by a camera or VTR. Along the way the word was borrowed from the technical vocabulary and later came to mean the large body of video equipment technology, especially the small-format gear. The term VIDEO has since been expanded to include the whole broad middle ground between ALTERNATIVE TV and Broadcast TV. This middle ground takes in educational/industrial and institutional uses of video and/or just about any use of television equipment that isn't intended primarily for network broadcast use. But Video still continues to represent the large body of non-broadcast media enthusiasts—not limited to video freaks only—who do not want to call what they do with their cameras and VTRs TELEVISION. Thus, the term Video includes television equipment, and certain kinds of equipment uses but also refers to a certain body of people who use the equipment in a particular way.

VIDEO AND THE HOPE FOR SOCIAL CHANGE

And So it Came to Pass...

Soon after Sony introduced the first portapaks in 1969, a number of people immediately recognized the strong potential for social change inherent in the use of portable TV equipment. Early video experiments took many forms and were assigned labels such as *personal feedback, video interaction, turning the media in on itself, video triads*, etc. For the exhibitionist, Video was a dream come true. For the social documentarian, Video could record endless hours of conversations with the man on the street, and psychoanalysts could record their 48-hour marathon therapy sessions.

For the budding serious media producer, the small video system provided an opportunity to try camera angles, screen test talent (actors and actresses) and produce a rough first production involving parents, girlfriends, dogs, cats and lizards and whatever else happened to crawl, walk, slither or shuffle by during a taping session.

The *Video Bug* bit a lot of people and this was only the beginning. When folks began to see themselves on TV, the same place that *The President* appeared, along with all the other great idols of the *American-Hero-Dream-Machine*, nerves-deep in their subconscious minds began to come alive and twitch with excitement. Individuals joined together and formed video groups, some of which secured grants from federal, state and local entities while others simply invested their own money in portapaks to see and do for themselves what Video was all about.

Just what was or is Video? Some would say it's the immediacy of the image, the instant playback and the stark-naked stripped-to-the-bone reality of life as it is really seen or happens. Others would call it an electronic mirror that could enable an individual or a society to become more aware of itself and come to terms with its inner being.

A good way to keep in touch with happenings in the alternative video world is to subscribe to one or more of the alternative video publications. *Televisions Magazine*, by far the most comprehensive and ambitious journal available, covers Cable TV happenings, grant sources, new video hardware and programming events and regularly provides high quality political and social analyses of the video and television scene.

Address: **TELEVISIONS MAGAZINE**
P.O. Box 21068
Washington, DC 20009
Send $10 for 10 issues

For who's doing what and where in the USA and Canada, send for the:

VIDEO EXCHANGE DIRECTORY
261 Powell Street
Vancouver, 4, B.C.
CANADA

VIDEO VS. BROADCAST TV:

Because network broadcasting runs on specific and tight time structures, it must show only what might interest large masses of people. Since the broadcasters don't have time to go into depth on an issue, especially a controversial one, like the independent video or film producer who can devote his total energy to the subject, Broadcast TV generally finds itself limited to a slick and superficial treatment of a subject and thus it often becomes a slick superficial media.

> *"If you try to satisfy all of the people all of the time, you can't satisfy anyone very well."*

On the other hand, much of the content of low-budget, nonbroadcast Video programs is strictly local in nature and concerned only with the immediate community or environment. Large national networks can't direct their shows to a specific community because it is not economically feasible to produce shows that only 50 to 1000 people will watch.

Video then is *decentralization of media*. It can become a very personal statement, reflecting ideas and events and communicating information for perhaps only a single city block of people. What we have here is a true medium for the people and for individual applications. It can serve the small folks and the nation as well. And that's why it excites a lot of people and motivates them sufficiently to somehow get their hands on a portapak, or whatever, and *make tapes!*

And just how to relate to the machinery and make good tapes is what this book is all about. The Whole Video Universe represents an exciting creative adventure, and it can open your eyes to new ways of perceiving for yourself or communicating with others. This author intends merely to act as a medium through which you the reader may naturally and enjoyably allow the embrace of the Video Universe to slip around you.

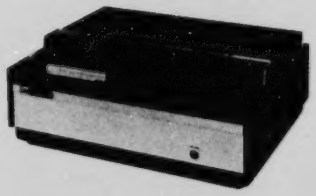
Chapter 2
A Grand Tour Of Video Technology

For those of you approaching Video for the first time, a brief historical perspective on the evolution of small-format video systems should provide a clearer understanding of why there are so many different kinds of videotape formats.

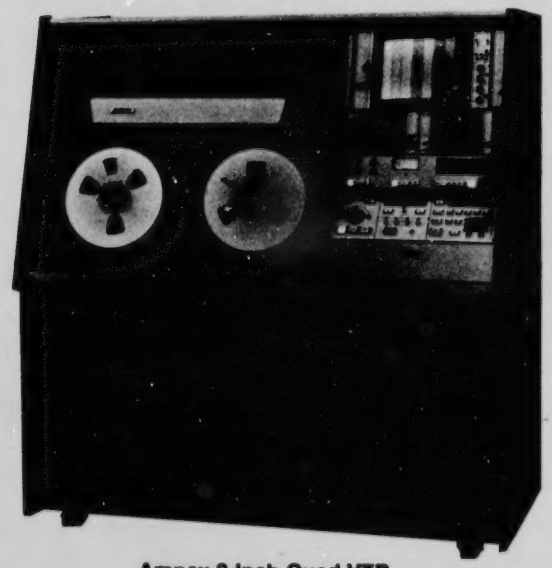
Large-Format and Small-Format Video Systems

The terms LARGE-FORMAT or SMALL-FORMAT video equipment generally refer to the size or width of the videotape used on a particular videotape recorder (VTR) or videocassette recorder (VCR). A typical broadcast VTR uses 2-inch wide videotape and would be referred to as LARGE-FORMAT while smaller VTRs, particularly portable VTRs and videocassette recorders using ½-inch or ¾-inch wide videotape are referred to as SMALL-FORMAT video equipment. More specifically, VTRs are also referred to by the size or width of the tape they use. Thus a VTR using ¾-inch wide videotape becomes known as a ¾-inch VTR.

The distinction between large and small-format VTRs should be clear enough, but there is the middle ground of 1-inch VTRs which don't really fit easily into either of the above categories. Certain 1-inch VTRs are very sophisticated and can be used for high quality broadcasting and editing, whereas most older 1-inch VTRs are inferior to the more sophisticated ½-inch and ¾-inch VTR systems. 1-inch VTRs are in a category by themselves and are greatly outnumbered by ¾-inch and ½-inch systems. Thus our historical tour of video technology will focus primarily on small-format (smaller than 1-inch) VTR systems.

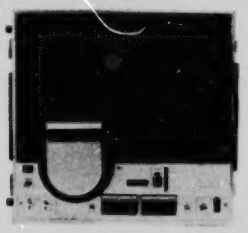


NEC ¾-Inch Videocassette Recorder (VC-8800)

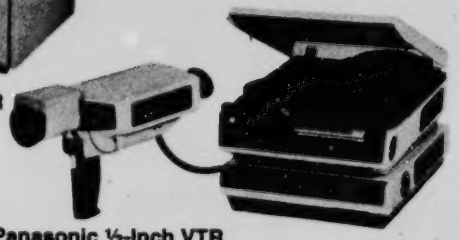


Ampex 2-Inch Quad VTR (AVR-3)

Ampex 1-Inch VTR (VPR-1)



Sony ½-Inch VTR



Panasonic ½-Inch VTR (WV-2200P/NV-3085

THE RISE OF SMALL FORMAT VIDEO TECHNOLOGY

Video really began when Sony discovered America and the first Sony PORTAPAKS (small portable ½-inch black-and-white VTRs and cameras) landed on the shores of the United States in 1967. The local natives showed considerable amazement when confronted with their own moving pictures and live voices played back to them instantly. Of course this strange device was immediately accepted as the new god of media and video visionaries came from miles around to pay homage, offer gifts, and make tapes wherever these electronic marvels were available.

As more equipment became available, the sales persons whose job it was to market this new technology claimed that video recorders would soon be commonplace in every home, school and business in America. Other Japanese manufacturers joined the bandwagon with their own video equipment and staked claims on the American market place.

Even though they used the same size videotape, these early VTRs had no common compatibility, so buyers of these first models could play back their tapes only on the same machine on which they were recorded. Some portable models couldn't even do that!

Then, in 1969, Japanese manufacturers finally got together and decided to standardize the ½-inch videotape format. Now nearly all ½-inch open-reel or reel-to-reel VTRs (both color and black-and-white) conform to the agreed on EIAJ (Electronic Industries Association of Japan) standard. Sometimes this standard is also called the EIAJ TYPE 1 STANDARD. Standardization is not a major problem with cameras and monitors, because they are passive devices and are usually interchangeable and compatible with any type VTR.

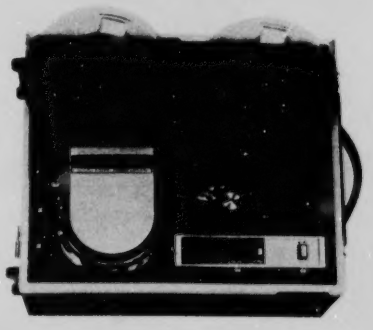
Impact on the Market Place

A great video boom came with the standardization of ½-inch videotape systems as schools, industry and video groups scrambled to get the "new generation" standardized portapaks and other VTRs. A greatly improved video recording capability also resulted from this standardization. Picture quality, electronic precision, mechanical stability and versatility of the ½-inch video machines were improved substantially.

Electronic video editing and tape copying now became possible, and tapes made on other manufacturers' standardized VTRs could be played back easily. Program producers could now think seriously about making low-cost videotapes for local, regional or national distribution.

Improvement of ½-Inch EIAJ VTRs

Since the introduction of the EIAJ standardized VTR format in 1969, video manufacturers have steadily improved both the equipment and the actual videotape stock. Sony and Panasonic introduced ½-inch b&w (black-and-white) electronic editor VTRs in 1970 and introduced portable color VTRs in 1972 and 1973.



Sony B&W Studio Recorder

JVC Color Portable System

Sony VideoRover System

½-Inch EIAJ VTR Systems

Nonportable studio ½-inch color VTRs also became available during 1972 and 1973.

About this same time, Panasonic introduced a ½-inch color editor, the NV-3130, which became a real workhorse for video production and editing.

Panasonic NV-3130 Color Editor VTR

Second Generation ½-inch Electronic Editors

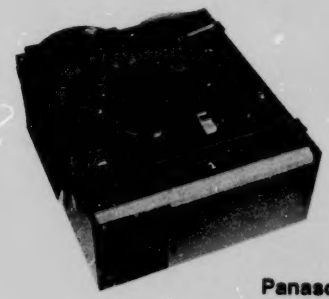
Finally in 1974, Sony introduced the long awaited AV-8650, a magnificent masterpiece of technology that represented the state-of-the-art of ½-inch color and b&w production and editing. The Sony AV-8650 featured perfectly clean editing with nearly every kind of edit control feature possible on a ½-inch VTR.

Sony AV-8650
Color Editor VTR

Not to be outdone, Panasonic soon countered with its second generation ½-inch color video editor, the NV-3160. It imitated all the important functions of the AV-8650 but added some very useful additional features:

-The ability to switch cleanly on the VTR between two camera sources while recording.
-The ability to lock up several NV-3160s together with a switcher and special effects generator, allowing video material from several VTRs to be fed into a single switching and recording source.

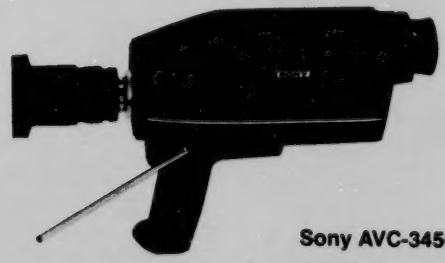
However, the NV-3160 has a slight audio delay following an edit, and Panasonic VTRs in general tend to be slightly less sharp picture-wise than Sony VTRs. On the other hand, Panasonic machines do offer more goodies (features) and sometimes better design characteristics than Sony VTRs.



Panasonic NV-3160
Color Editor VTR

Cameras

To keep pace manufacturers improved their cameras too—most notably, the black-and-white portable cameras which utilized a new type of camera tube assembly called an ELECTROSTATIC YOKE. This design eliminated the heavy magnets around the camera tube, allowing considerable reduction in both camera size and weight (to around 4 pounds). These sensitive camera tubes and improved camera circuitry permitted better pictures in both daylight and low-light situations. Most black-and-white cameras are similar in design and newer models have excellent resolution and light sensitivity.



Sony AVC-3450
B&W Camera

½-Inch Cartridge VTRs

Two manufacturers—Panasonic and Hitachi-Shibaden—decided that video users would like to have a VTR that would thread the tape automatically. So they introduced a line of self-threading ½-inch CARTRIDGE VTRs. Panasonic referred to its line of ½-inch cartridge products as OMNI-VISION

With a degree of foresight uncommon to the industry, the ½-inch CARTRIDGE format was designed to be physically compatible with the ½-inch EIAJ standard. However, the tape itself would have to be placed in a special cartridge housing if it were to be played on a cartridge VTR. Likewise, the tape had to be removed from the cartridge housing if it were to be played on a non-cartridge VTR.

Panasonic "Omnivision"

As it turned out, the ½-inch cartridge VTR format encountered a very cool reception from video users, because Sony Corporation (the largest video manufacturer) refused to have anything to do with the cartridge VTR concept at that time. Sony's major commitment was to its own new ¾-inch VIDEOCASSETTE format. The ½-inch EIAJ cartridge format did catch on in a small way with real estate training networks and some state hospitals, but the market impact was minor compared with the ¾-inch videocassette format.

Sanyo Non-EIAJ ½-inch Cartridge Format

Sanyo Corporation produced a line of ½-inch cartridge video equipment that was both unique in design and not compatible. The Sanyo equipment featured a ½-inch cartridge portapak that recorded 20 minutes of tape in b&w and provided very good quality SLOW MOTION playback of the tape as well. The slow-motion and cartridge capability might tempt users to overlook the serious drawback of incompatibility. A portable slow-motion unit such as this would be useful for sports applications but limited for serious program production.

Akai ¼-Inch and ½-Inch Video Systems

Meanwhile, as Sony, Panasonic and the others continued concocting exotic new ½-inch technology, still another Japanese firm, AKAI INC., defiantly marketed its ¼-inch videotape system which was unfortunately compatible with nothing but itself. The maverick company followed right alongside the ½-inch folks, evolving its black-and-white ¼-inch portapak and basic editing VTR. Akai later succeeded in mass producing the world's first low-cost hand-held color portable camera in 1973.

The Akai VT-150 portable color camera was indeed a technical breakthrough for video and preceded the first Sony and Panasonic portable color cameras by about two years. As a result, the Akai color camera was improved, adapted for use with the Sony color ½-inch portable VTR and soon found its way into limited use for news broadcasting on some TV stations.

Akai VTS-150 XL-1 ¼-Inch System

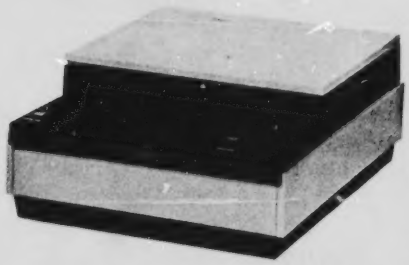
Akai VT-300 ½-Inch Cassette System

Akai also offered its own ¼-inch portable VTR to accompany the camera, but the ¼-inch format never had much impact on the serious video user who preferred the superior quality and flexibility of the ½-inch EIAJ format.

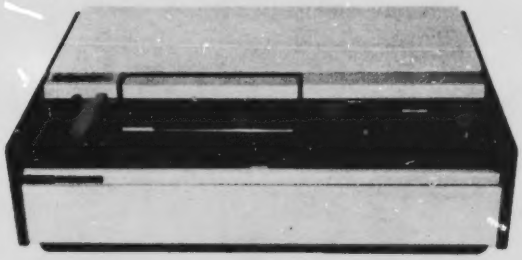
In 1977, Akai brought out another industry first—the lightest weight and the most compact ½-inch b&w portable videocassette system on the market. A unique modular design system, the VT-300 clearly foretold the future trend in video equipment design. Of course, the VT-300 is a special Akai format and is not compatible with non-Akai systems.

The Videocassette—A Giant Step Forward

In 1972, Sony unveiled the result of many years of hard work and an investment of millions of dollars. The curtain went up on *The Age of the Videocassette*. Video now could take perhaps the greatest leap forward to date.



Early Prototype



First Production Model

The videocassette tape housing has 2 reels inside it as opposed to the videocartridge's single reel of tape. These design differences make the videocassette somewhat larger than the videocartridge tape housing but permit much longer playing times. The videocassette and videocartridge design differences are similar to that of the audiocassette vs. the 8-track audiocartridge.

Although the cassette format was originally marketed as a distribution rather than a production tool, initial reaction to the concept was mixed. "Not another format! Can't they agree on anything? What's going to happen to all my ½-inch gear?," users cried in desperation. According to the SOFTWARE (programming) people, vast markets would now open up for educational and entertainment video programming. However, very low-budget video people didn't pay much attention to the videocassette at first because it wasn't portable, you couldn't use it for editing, it was more expensive than comparable ½-inch gear, and tape distribution systems already were established on ½-inch tape.

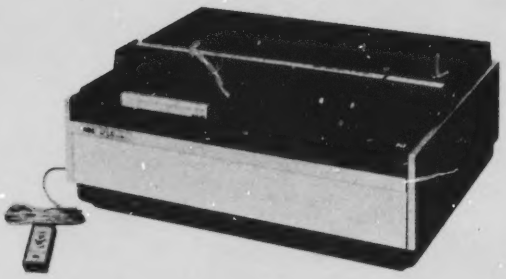
But as Sony goes, so goes the video world. Within a few years, over 250,000 units of the ¾-inch U-MATIC (Sony trademark name) videocassette system were in regular use, mostly in the USA, and the demand for machines often outstripped production.

Several factors contributed to the rapid interest in videocassette systems: the self-contained nature of the videocassette (no threading the tape); the superior picture quality of the system compared with the ½-inch format; and the extreme ease of operation.

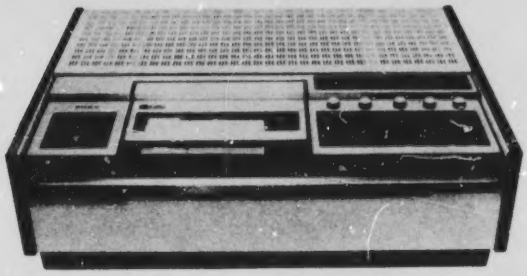
Sony pioneered and developed the basic loading and operational mechanism of the ¾-inch U-Matic videocassette system. However, numerous other manufacturers sell comparable ¾-inch U-Matic systems that are interchangeable with other ¾-inch videocassette units, because they all incorporate the same basic internal mechanism under license to Sony Corporation.

Thus JVC, Panasonic, Concord, Wollensak, Telemation, NEC (Nippon Electric Co.) and Sony ¾-inch systems are all interchangeable with each other. No other ¾-inch U-Matic videocassette format exists, so if you have a ¾-inch videocassette, you can play it on any of the ¾-inch machines made by the companies listed above regardless of model.

Panasonic NV-9500



NEC VC-8505



Sony VO-2850

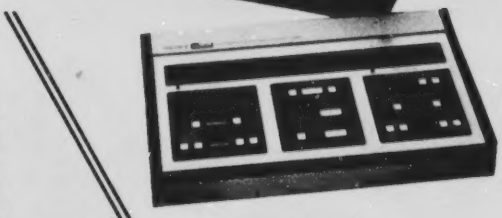
It didn't take long for video producers to start complaining about the lack of editing capability of the ¾-inch format since the original machines were quite basic. Critics praised the color quality of the machines, but felt they could never be made portable and would always lack precise editing control.

Sony Type II Videocassette Technology

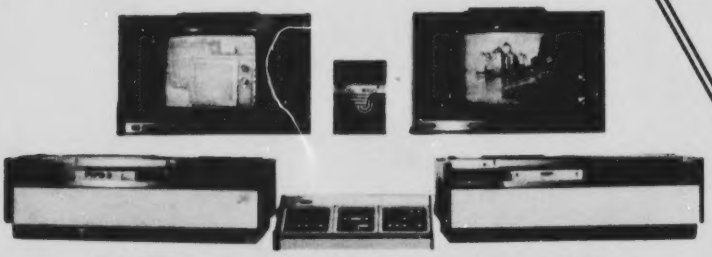
In 1974, Sony introduced a second generation U-Matic videocassette recorder called the Type II. This machine was completely compatible with any other ¾-inch U-Matic, featured a simplified tape threading mechanism, offered a near broadcast picture quality and had excellent internal mechanical stability.

The first model was called the VO-2850 which cost $6,000 and featured a wide variety of editing functions. Sony also introduced an automatic CONTROLLER-EDITOR (the RM-400) which enabled the operator to edit accurately between 2 VO-2850s. The VO-2850 was followed later by the more sophisticated VO-2860/RM-430 editing system which featured additional editing abilities, special Time Base Corrector and dubbing connections, better picture quality and the ability to interface with certain Betamax ½-inch videocassette units for editing and duplication.

VO-2860

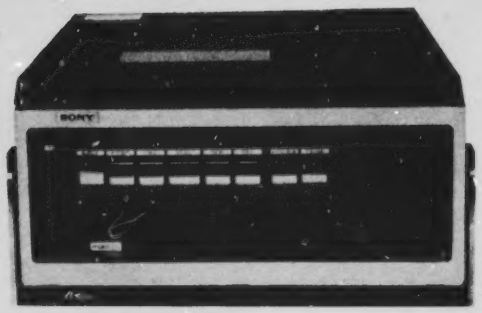


RM-430
Editing Control Console



VO-2850 RM-400 VO-2850
Editing Control Console

Sony Color U-Matic
Videocassette Editing Systems



Sony VO-3800

The original Sony VO-2850 editing system dazzled everyone. As a double whammy, Sony also unveiled its portable ¾-inch U-Matic, the VO-3800. "They said it couldn't be done," boasted the Sony salespersons, sporting broad smiles that hardly disguised their feeling of proud satisfaction. As it turned out, the VO-2850 and the VO-3800 were to be the foundation elements for a major takeover of film in TV news broadcasting.

Videocassettes and Time Base Correctors

But, good picture quality alone is not sufficient to get ¾-inch on the air, and editing control of the VO-2850s still was not adequate. So, a device called a TIME BASE CORRECTOR (TBC), developed by Consolidated Video Systems (CVS) in 1973 was mated with the small-format VTR systems to make them viable broadcast production tools.

Soon, aerospace and computer companies combined the Time Base Corrector and videocassette recorders with computer control and memory systems. This achieved perfect editing control with accuracy to a single frame, special effects, dissolves between prerecorded videotapes, and many other useful features.

CMX 340X

COMPUTER EDITING SYSTEM

Birth of ENG

Once easy and precise videocassette editing was achieved, the TBC perfected, and the portable videocassette recorder introduced, ENG (ELECTRONIC NEWS GATHERING) or EJ (ELECTRONIC JOURNALISM) became a reality. Since quality video equipment had become portable and much less costly, TV stations began replacing their film news equipment with the new video technology.

As early as 1974, TV stations began to use the small low-cost Akai color camera for news, and CBS covered Nixon's trip to Russia solely with ¾-inch videocassette recorders feeding taped video programs directly to the USA via broadcast TV satellites.

Also in 1974, PBS (Public Broadcasting System) aired the first national ½-inch color documentary. Downtown Community Television—DCTV—of New York City produced the show called "Cuba, the People," using the JVC ½-inch color portapak. In 1975, a CBS station in St. Louis switched to all-electronic newsgathering, and the great ENG video gold rush was on.

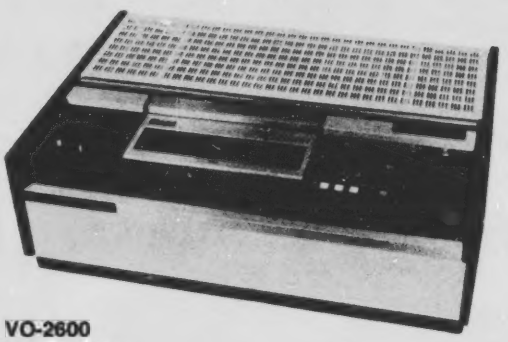
Other ENG Systems

Late in 1974, Sony introduced its own low-cost ($5,000) portable hand-held camera to be used primarily with the VO-3800 portable videocassette recorder. Other manufacturers, such as JVC, also have introduced ¾-inch technology intended for the broadcast market. The JVC color ¾-inch portapak features good quality color recording and reproduction and offers an automatic in the camera editing feature as well, which allows the camera operator to edit as he shoots. *See Chapter 13 — ENG and Portable Videocassette Systems.*

JVC ¾-Inch Portable Color VCR

The relatively high cost of ¾-inch editing and portable videocassette color equipment prevented most small format video producers and low budget educational/institutional users from taking advantage of the improved quality systems. As a solution to this problem, SONY soon introduced a full line of lower priced sophisticated Type II videocassette recorders and players.

VP-2000
Playback Only



VO-2600
Record/Play

VO-2800
Record/Play/Edit

Sony's U-matic Type II

Prices of these machines ranged from $1,200 to $3,600 and all units included new tape loading and transport systems and improved picture quality. Additional features such as touch-type solenoid controls and full LOCK OUT LOGIC in control functions made it impossible to push the wrong button at the wrong time. JVC and Panasonic followed suit and introduced their new improved models also.

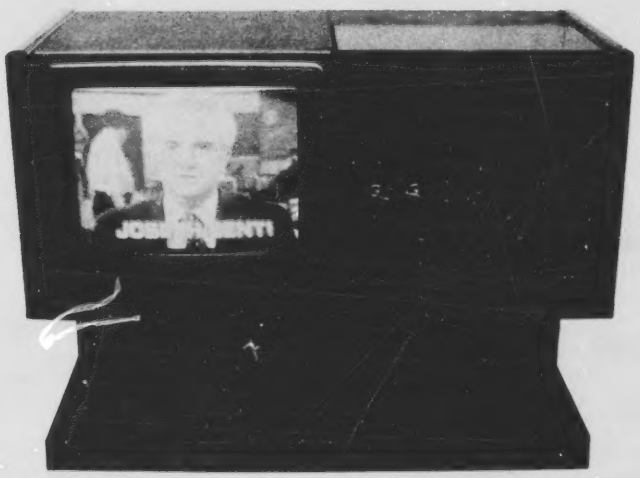
The impact of this full range of ¾-inch video technology has yet to be felt. Sony added further improvements and sophistication to the VO-2850 videocassette editor (called the BVU-200). The BVU-200 features more precise electronic circuitry and special tape transport operations and cueing functions. A few thousand dollars also have been added to the price tag. These very sophisticated VTRs are intended exclusively for TV broadcasters.

Nevertheless, using TBCs and ¾-inch technology, a complete basic color broadcast TV studio and remote control operation could be established for $80,000 to $100,000 (less a transmitter)—figures which are unbelievably low, since TV broadcasters are accustomed to spending a minimum of half a million dollars to get on the air.

This means that over-the-air TV broadcasting stations are now within the financial reach of many public groups. A real problem is how to get allocation of a TV channel, because there are very few available. Nevertheless, lower costs for television equipment hopefully will lead to a wider variety of television programming and a greater minority appeal.

VIDEO FOR THE HOME

Home video systems have always been the logical extension of the home entertainment/informational concept—especially to video manufacturers. For several years, though, there was much talk about a VIDEO DISC system that would open up the lucrative home market to video. The Videodisc people were convinced that images recorded on cheap plastic discs could be sold less expensively than comparable programs on videotape, and the videodisc player systems would be less expensive and more practical than videotape systems.



Sony Betamax LV-1901

The Betamax Video System

Rumors about the impending video disc revolution led Sony engineers to burn the midnight oil to come up with an affordable home videotape system to compete with the videodisc. Originally the ¾-inch U-Matic was intended to be that home videotape system, but inflation, an economic slump, and pressure by producers to improve the ¾-inch system for master production and editing caused Sony to go the other way, increasing the cost and sophistication of the U-Matic instead of simplifying it. In addition, the cost of blank tape alone—$25 to $35 an hour—clearly eliminated any possibility of the ¾-inch format ever having a future on the home market. Enter THE BETAMAX!

The first Betamax was a console model which included a 1-hour only recorder and a 19-inch Trinitron TV set. The Betamax incorporated its own separate TV tuner so you could watch one program on the TV set and record a different program on the video recorder using its own separate tuner. Home video was born!

This first 1-hour system was soon followed by other 1-hour systems and then a whole assortment of 2 and 4-hour home video systems—unfortunately not all compatible with each other.

Most home video systems are STAND-ALONE deck type models which connect to any standard home TV set and contain built-in TV tuners, input connectors for video cameras and microphones for live recording, and provide digital 24-hour clock/timers for automatic unattended off-the-air recording of TV programs.

There are 2 major opposing formats—the BETAMAX or BETA format and the VHS (Video Home System) format. A third minor maverick entry is the QUASAR format. Most home video units use either the Beta format or the VHS format. Many Beta format machines are selectable for either 1 or 2 hours recording on a single tape cassette, and most VHS units can record for either 2 or 4 hours. Often there is some slight loss of audio or video quality in the longer modes because the tape speed is halved and the frequency response is reduced, although special circuitry is included to aid picture quality in the extended play modes.

Compatibility of Home Video Systems

All home videocassette systems utilize a ½-inch non-EIAJ videocassette that is hardly larger in size than an audiocassette. The tape speed of the 2-hour Betamax format is a mere .79 inches per second, and the picture and sound quality is truly remarkable for such a compact machine using such slow moving tape. The quality of the taped off-the-air program is nearly indistinguishable from the original broadcast.

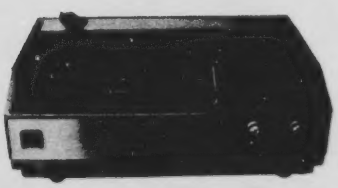
Machines using the Beta format include the Sony SL-8200 and SL-8600, Sanyo Betacord, Toshiba Betaformat, Sears BetaVision and Zenith. Some machines feature both 1 and 2 hour recording and playback modes, and some only provide the 2-hour mode. Most VHS format machines provide both a 2 and 4-hour recording and playback mode and distributors include Panasonic, Sylvania, Hitachi, Magnavox, Quasar, RCA, GE, Sharp, JVC and others. The JVC VHS machines are capable of 2-hour mode recording and playback only.

Tapes made on the Beta format *can not* be played on the VHS format in any mode and vice versa. Retail prices of the various machines range from $1,000 to $1,700, depending on features and availability. Retail prices of tapes vary from $15 for a 2-hour tape to $25 for a 4-hour tape. Price competition and discounting lower the retail prices considerably.

Sears BetaVision

Sony Betamax SL-8200

Panasonic VHS System



RCA VHS System

½-Inch Home Videocassette Systems

JVC Vidstar VHS System

Programming and Accessories

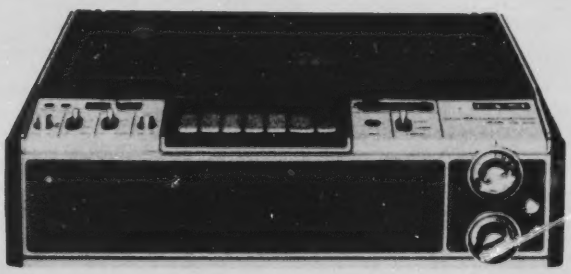
Simple black and white cameras are available for $300 or $400, and color cameras for $900 to $3,500. Extended play tapes are offered for Beta and VHS machines, thereby increasing recording times. RCA and Magnavox have programmable VCRs which allow the user to program the VCR in advance to turn itself off and on up to four times and automatically record programs on different channels at different times. JVC has a VHS format battery powered portable color camera and VCR system, and Sony has a Beta format portable system too. JVC also has a VCR that allows double-speed playback with intelligible audio. So, there's lots to choose from.

Other ½-inch Videocassette Systems

It's important to note that Sony produces a number of 1-hour only ½-inch videocassette systems generally referred to as Betamax 1-hour format systems. These 1-hour videocassette units are intended primarily for institutional/educational use for live recording, playback, and editing, and semi-professional program production. These 1-hour machines are not compatible with the 2-hour Beta videocassette units. *(See p. 109).*

Sanyo Videocassette Systems

Soon after the first 1-hour Betamax was introduced, Sanyo Electric Inc. brought out its home videocassette recorder. The Sanyo V-Cord II featured automatic timer capability, high quality color picture reproduction and a unique switchable STANDARD PLAY mode of 1-hour or a "LP" mode of 2 hours. Although the V-Cord II is not compatible with the Betamax, it nevertheless has a number of advantageous features such as locking pause control for stop action, memory digital counter and automatic program locating ability. Sanyo also produces a compact 2-hour Beta format videocassette unit called the BETACORD.



Sanyo V-Cord II VTC-8200

¾-Inch Cassette vs. ½-Inch Cassette

A logical question then comes to mind. Why invest in ¾-inch technology if the ½-inch cassette is so good? At present, the ¾-inch format is intended primarily for industrial/educational and broadcast master production and editing applications. The ¾-inch format is more accurate both mechanically and electronically; has better picture quality and a wide variety of modes (portable and editing); offers two audio tracks compared with only one on the ½-inch cassette format; has a giant library of programming already available; includes a large assortment of peripheral technologies; and has industry acceptance as a proven and standard technology.

THE VIDEODISC

As you can see, most of the technology of video involves magnetic tape systems. Another way to record pictures is on videodiscs. The videodisc recording concept has several unique capabilities. Discs take up very little space and in large quantities can be manufactured at a much lower cost than magnetic tape. Discs are also ideal for random access; that is, indexing a section in the middle of a tape without having to wind through hundreds of feet of material. TV networks regularly maintain very sophisticated videodisc systems for instant replay of sports and for special slow-motion or stop-frame effects on TV specials. These elaborate disc systems cost from $40,000 to $100,000 each.

Several manufacturers have been working on a number of *playback only* videodisc systems for home use. Unfortunately, all the designs so far have been incompatible with each other. But with the videodisc, standardization is a must before it can become a household reality because it is completely dependent on pre-recorded programming.

Two types of videodisc systems basically exist—the OPTICAL type which employs a laser beam to recover electronically encoded information on the disc, and the CAPACITANCE type which uses a special stylus tracking arm to sense the disc information.

Philips/MCA has been producing an optical system which uses a 12-inch grooveless disc that connects to any TV set and plays video and stereo audio for 1 hour on each side of the home system and 30 minutes on each side in the industrial (DISCO-VISION) system. A single

copy duplication system for the industrial system will also be available. The industrial system allows random access search, freeze frame, slow motion and reverse motion and is able to store 54,000 frames or pages of information on each side. The longer playing home version, distributed by Magnavox, does not have all the features of the industrial version. Since there is no friction between the optical pickup beam and the coated disc, there is no wear, and the disc is protected from dust and fingerprints. Cost of the home system is around $500.

JVC VHD/AHD Disc System

JVC, RCA and others have been experimenting with capacitance systems of which the JVC system is a refinement. The JVC VHD/AHD system uses a special servo-controlled cantilever sapphire stylus pickup arm which senses the electronic information and tracking signals encoded in the grooveless electro-conductive plastic disc. These multiple "pits" guide the arm over the audio information on each side. The disc travels at 900 rpm vs 1800 rpm for the Philips system.

Because the disc is grooveless, the stylus can move rapidly and randomly, thereby allowing normal forward and reverse motion, and still frame and slow motion forward and reverse in the VHD (VIDEO HOME DISC) mode. Super hi-fi is possible in the AHD (AUDIO HOME DISC) mode with an accessory PCM (PULSE CODE MODULATION) device. An accessory ramdom access unit and microprocessor allows programming the disc for automatic search and pre-selected playing modes with both video and audio programs. Wireless remote control is also available. Costs of pre-recorded discs are generally 20% to 50% higher than audio records.

Videotape Vs. Videodisc

Because tape and discs are really related in the sense that they are both electronic mediums, they can work to mutual advantage. Video programs will always be recorded on film or tape in the forseeable future and edited in the film or tape mode and then copied on videodiscs. The potential of the videodisc really lies in the low-cost distribution of programming, not in the production of programming, as this is better done by videotape or film.

Philips/MCA Laser Disc System

THE FUTURE

The videodisc may furnish the media with its long sought-after pot at the end of the rainbow—the cheap easy-to-use home audio/visual playback system. Certainly, we have heard these heralds many times before, and I'm sure we'll hear them again. On the horizon we have 3-D holographic technology, such as Sony's MAVICA magnetic card recording system, and Hitachi's 12-inch holographic disc, which are due on the market in the 1980's.

We know from studies made that TV shapes human behavior. It is therefore obvious that we need alternatives to present media programming. New technology integrated into a receptive social environment on a large scale can bring about considerable change. This change will not necessarily guarantee human progress. Hopefully, the videodisc will not merely proliferate more visual and aural trash but instead will broaden the range of constructive information and communication between people. This is the real media challenge of the future.

VIDEO CHRONOLOGY

YEAR	EVENT	CREATOR
1947	TV broadcasting begins	CBS, NBC, ABC
1948	16,500 TV sets sold	TV manufacturers
1956	First practical black-and-white VTR	Ampex
1967	First generation ½-inch portable VTR introduced to market	Sony
1968	First practical color VTR (2-inch)	Ampex
1969	Video transmission live from moon	NASA- RCA
1970	Standardization of ½-inch videotape	EIAJ
1970	Standardized full function ½-inch portable and ½-inch editor VTR	Sony
1970	Radical Software Magazine published	Raindance Corp.
1972	Public Access Cable TV programming begins	Teleprompter Corp.
1972	First video feature movie—"200 Motels"	Frank Zappa
1972	Frequent use of ½-inch videotape on Cable TV	Video groups
1972	First use of ½-inch videotape on Broadcast TV—Republican National Convention	TVTV (Top Value Television)
1972	Commercial production of ¾-inch videocassette recorders	Sony
1973	Low-cost color video projection system marketed	Sony/Advent
1973	Introduction of the Time Base Corrector	CVS
1973	"Video, The New Wave," - 1 hour documentary on ½-inch video and Video Art broadcast on PBS system	WGBH—Boston
1973	First low-cost color portable camera	Akai/Magnavox
1973	Editing ½-inch color VTR	Panasonic
1974	CBS uses ENG system for news; portable Ikegami camera used with IVC 1-inch VTR and TBC	CBS
1974	Introduction of 2nd-generation videocassette recorder—VO-2850 and full-function high-quality automatic videocassette editing system	Sony
1974	Introduction of first portable ¾-inch videocassette recorder—VO-3800	Sony
1974	First national ½-inch color documentary, "Cuba, The People," produced by DCTV using JVC ½-inch color portapak	DCTV
1974	First viewer sponsored TV station KVST-LA (Would have provided good broadcast outlet for local and independently produced videotapes—closed in 1976)	KVST
1975	TRI and CMX automated and computer editing systems for ¾-inch and ½-inch video systems	CMX and TRI
1975	ENG well underway—networks purchase and regularly use ¾-inch video equipment for production and editing	Sony
1975	Introduction of Betamax home video system	Sony
1976	More TV sets than telephones or cars—364 million TV sets worldwide	TV manufacturers
1976	Introduction of full line of small-format broadcast video equipment	Sony/JVC
1977	Beta ("B") 2-hour and VHS home 2/4-hour videocassette recording formats introduced	Sony, Matsushita
1978	First practical home portable VCR and color camera—VHS format	JVC

Chapter 3
The Video System
What You Need To Make It Work

Getting Started in Video

The school principal has just informed you that you have received funding for all the video equipment requested by your big Audio Visual Grant; the one you didn't really think would come through.

Ten months ago, you had a great idea to do vocational training tapes for your high-school students. Ever since you read that there were more TV sets in America than homes with toilets and that kids watch some 26,000 hours of television by the time they graduate from high school, you logically assumed that this was the medium to which they would really relate.

The video equipment brochures sent to you from "Whitney's Sight and Sound Center" seemed to be somewhat understandable and anyway, the salesperson assured you he would help "plug it all in." Ten months ago, it seemed a remote possibility that the Grant would ever materialize so you didn't need to worry about equipment for a while.

But it did– and now you do!

THE MACHINE AND YOU

As we turn our attention to these remarkable video machines, I'm sure many of you are anticipating working with the equipment with a certain sense of fear and anxiety. Your mind is full of questions like: "Look at all those knobs and dials, how do you know which monitor to watch or which button to push? How am I going to keep all the cables straight? Those things don't look like any plugs I've ever seen before!"

These are normal reactions. Don't worry; if you had to confront a big 2-inch VTR, you would have cause to be concerned. However, small-format machines have been designed to minimize operator confusion and error and to make operation as simple as possible. If you can comprehend a washing machine or an electric typewriter, you've got the mechanical and psychological foundation to understand basic video equipment.

Attitude

Before we plunge headlong into the abyss, let's talk about something often overlooked but of vital importance, in my opinion. That is *attitude*– your personal conception of and approach to technology in general. If you take the attitude that technology tends to frustrate and alienate people, you've got a good point. Technology itself, however, is merely a tool–neither intrinsically good nor bad.

It's effect on a society is determined by the people who create it, those who manufacture its products, and the people who use the products. Technology can be used to victimize and to alienate people or to free civilization from certain kinds of manual labor, thereby permitting individuals to spend more time developing their own creative potential, if they so desire.

How do we insure the positive and minimize the negative use of technology? I think through approaching existing and future technology with some sense of inner understanding or peace of mind. You can't be a hypertense, frantic individual and expect to operate a videotape recorder successfully, at least not for very long. The machine simply cannot defend itself against this kind of personality. If you hate machines, you should stay away from video, as this hatred will soon become self-defeating. The machinery will not respond, will soon break down, and any programs produced will reflect these negative emotions.

On the other hand, if you can sit down in front of the machines and quietly attempt to "feel them out" mentally, inanimate objects that they are, you might be able to develop a positive feeling for the machinery. You can do this if you are willing.

When something doesn't work or you have no idea how you're going to operate an unfamiliar device, don't just freak out and adopt a defensive attitude. Take a few minutes, meditate on the apparently insoluble problem, then approach both the job and the machine with the sole intention of working step-by-step to solve the problem. You must convince yourself that the answer is there within you and the machine, and you need only proceed step by step to find it. Refuse to accept defeat until you have given it a good try.

Now to return to the idea of your peace of mind. This is the key to successful video operation. The word technology was originally derived from the word TECHNE meaning ART. So technology should be and can be an art. Certainly most American cars and other consumer products can hardly be called works of art, but that problem lies in the insensitivity of the creators and builders to any awareness of natural beauty and to the real needs of the persons who use their products. This is not the case with most video products, fortunately. The Japanese have a strong sense of natural beauty and careful craftsmanship when it comes to designing and building videotape systems. I have never seen sloppy workmanship on Japanese video equipment. There may be design flaws, but generally an enormous amount of care is evident in video equipment construction and assembly.

Since the builders crafted this equipment with a sense of natural design and care so it would work easily for years, you must approach it as the recipient of this TLC (tender loving care) and the design expertise placed in your equipment by the builder.

Taking the Medium into Your Own Hands

As you turn to technology's tools to craft your own visualizations in the form of educational tapes, social documentaries, video art, or whatever it is that you want to do, consider what happens when electricity flows through a video system. Hundreds of minute and extremely complex solid state transistors, resistors, capacitors, diodes and other devices respond with a sparkling life force uniquely their own. You need only take a good look inside any videotape recorder to appreciate the exquisite work of art, sculpture and design that you will see. Remember, that any successful interaction with video equipment, even on a casual level, requires that you approach the video recorder or camera as a sensitive instrument, rather than a mass of plastic, metal and wood that is just supposed to work properly all the time.

Whether or not the machine operates up to your expectations depends substantially on your own inner togetherness. If you can approach this equipment with a certain degree of inner peace of mind, half your battle is won. Otherwise, you will only build your personal problems into the machine itself and into the end product of your efforts.

If your mind is calm and centered, the videotape recorder or camera will produce good things for you and you'll feel good about it. If you experience severe equipment and production problems, perhaps you should look inside yourself and do some internal house-cleaning. But we will assume you are eager and ready to go, so let's take a look at the equipment itself.

What Makes it Work?

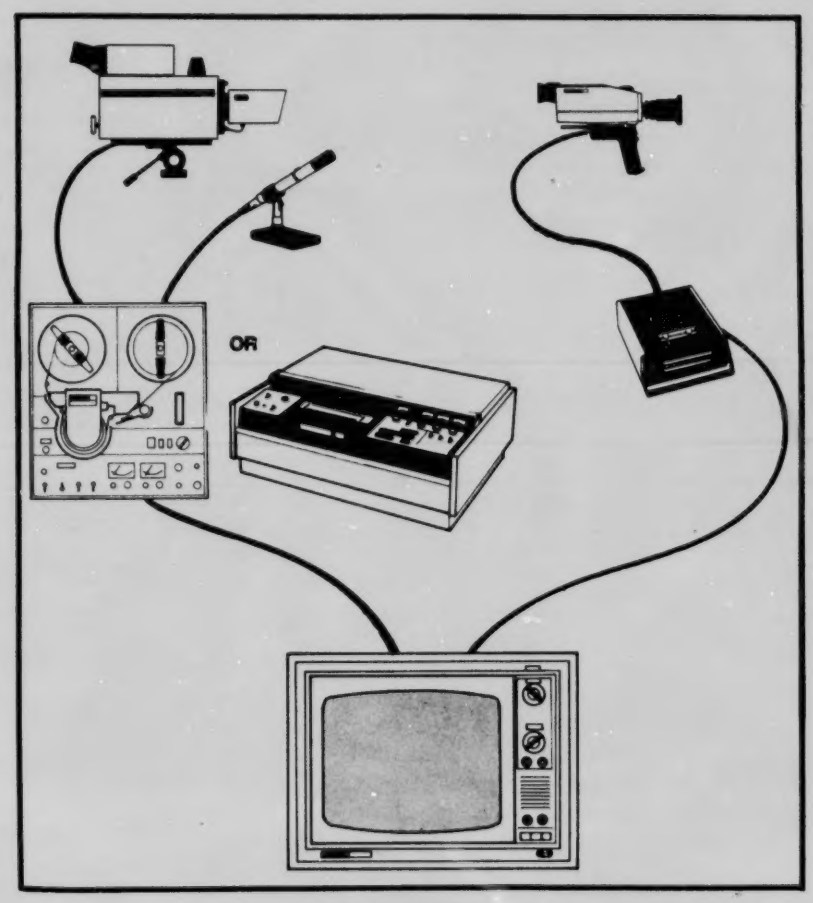
A basic understanding of the technical processes hidden behind all those knobs and meters is essential if the specific pieces of video hardware are to have meaning for you.

THE COMPLETE VIDEO SYSTEM MUST INCLUDE:

A CAMERA (studio or portable) to take pictures and a microphone to record sound.

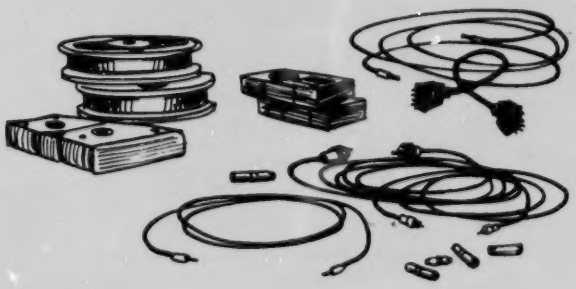
A VIDEOTAPE RECORDER (VTR), (studio or portable) to record and play back the pictures and sound.

A TV MONITOR or TV receiver to display picture and sound.



VIDEOTAPE (reusable) to store the picture and sound.

CONNECTING CABLES to join the various components together.

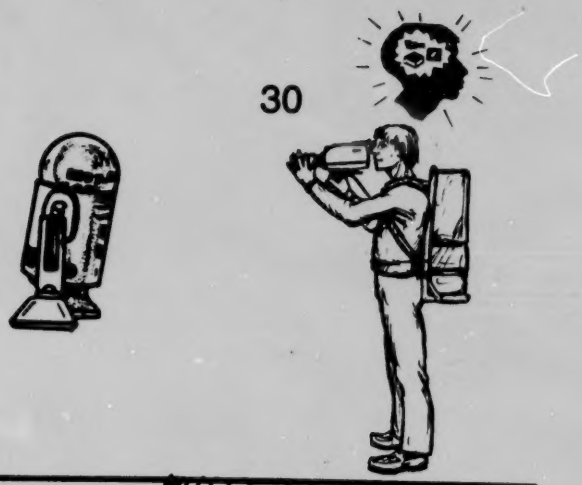


The purpose of a complete video system is to record and play back moving visual images and synchronized sound. Every video system has the capacity to play back picture and sound in perfect synchronization. Most video systems also have the capability to record sound and picture. Since videotape requires no processing, the recorded image can be played back immediately after recording. This can be done many times with the same tape.

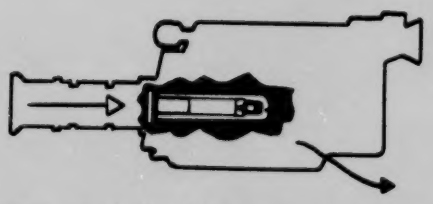
Not all video components are easily interchangeable so it is best to keep each item of equipment with its own component system. For example, keep the portable camera with its own VTR and cables and the studio camera with its own VTR and cables.

The Camera—Starting with the Image

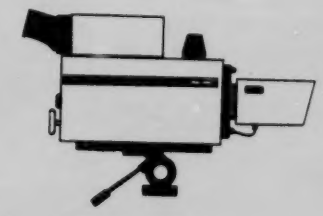
Unlike the film camera, the VIDEO CAMERA contains no tape or film and does not store the image. Instead, the video camera changes the light emitted or reflected from a physical image into an electronic signal. This signal or voltage is relayed by means of wires, lasers or microwaves to either a VTR for storage or to a TV monitor for "real-time" immediate display. If broadcasting live, the camera's picture would be instantly transmitted over the air.



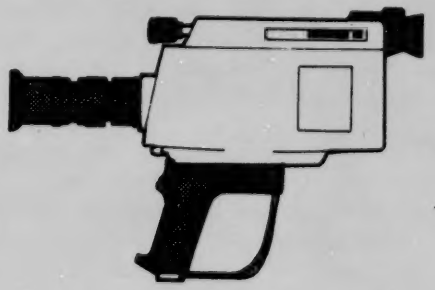
Inside the video camera, a light-sensitive device called a CAMERA TUBE changes the light from a physical form to an electronic signal.



Cameras generally fall into two categories—portable and nonportable or studio type.



Often a microphone is built into the portable camera. If not, a separate microphone must be used to record sound. Also, the electronic components within the camera determine whether or not the camera's pictures will be in color or black-and-white.

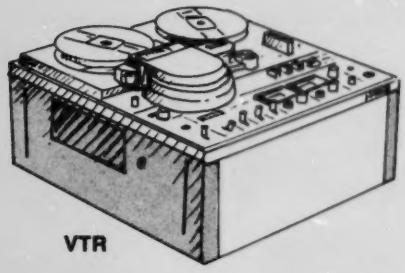


The Videotape Recorder (VTR)

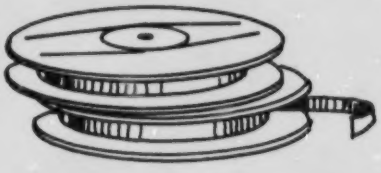
The VIDEOTAPE RECORDER or VTR receives the electronic picture signals from the camera and the sound signals from the microphone and stores this information on the videotape which has been placed on the VTR. Once the tape has been recorded by the VTR, it can be rewound and played back immediately through a connected TV monitor.

Since the VTR is the most mechanically complex element in the video system, its many circuits, relays, and motors must work perfectly to insure quality recording and reproduction. The VTR operator must take special care of the VTR, keep it clean, transport it gently, and treat it like the precision instrument that it is.

VTRs like cameras take many shapes and sizes depending on their intended purposes. Physically, they take two basic configurations, the portable type and the nonportable studio model.

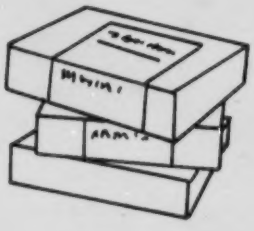


VTR

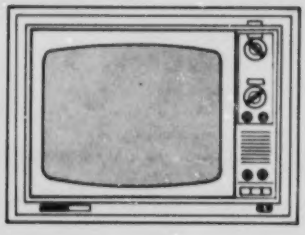


Videotape (Reel-to-Reel)

¾-Inch Videocassettes



Betamax Videocassettes



Monitor

The TV Monitor

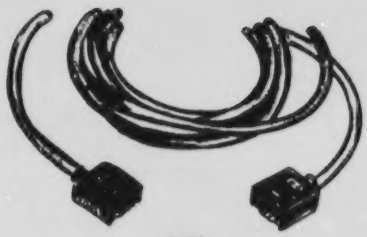
The TV MONITOR or MONITOR is the viewing element. Without some sort of monitor or TV set, no pictures can be viewed. With most video systems, especially the nonbroadcast type, the monitor will be an ordinary TV receiver and a TV monitor, and it is called a MONITOR/RECEIVER. This dual function is advantageous since it provides the capability to record off-the-air programs from broadcast TV and provides playback for a VTR or camera through the monitor.

The major difference between a TV monitor and an ordinary TV receiver is that a TV monitor is designed to display high-quality pictures from a video camera or VTR but usually does not have the capability to play back sound or tune in broadcast TV channels. Generally, a dual function TV monitor/receiver costs about $150 to $400 more than a comparable ordinary TV set. However, it is well worth the extra money to buy the monitor/receiver if substantial use with a video production system is contemplated.

Monitors exist in a wide variety of forms and like VTRs and cameras are either portable or nonportable and black-and-white or color.

Videotape

All pictures and sound signals are recorded and stored on videotape which is placed on the videotape recorder, not in the video camera. All videotape can record BOTH black-and-white and color signals. You don't need separate color and black-and-white stock as with film. Videotape comes in three basic lengths—20, 30 and 60 minutes. Special tapes are available that will record and play for 90 or 120 minutes. Tape comes in many brands and sizes so it is important to know which kind and size of tape you need for the particular VTR that you're using, because the quality and type of tape will affect the quality of your recording. *See Chapter 6—All About Videotape, and Chapter 9—Format and Interchangeability.*



8-Pin

Connectors

Finally, the various video equipment components must be joined together by means of wires and connectors. Although as many as 4 different cables may be used simultaneously with one video recorder, the cables and plugs are sufficiently unique to enable you to keep the cables and their specific functions separate. This prevents you from plugging the wrong cable into the wrong plug.

Black-and-White or Color?

The relative merits of b&w vs. color video equipment should be carefully considered before making any equipment purchase. Surveillance and low-light level applications are clearly more practical applications for b&w, as is simple role playing, production of certain kinds of basic training tapes and situations where persons want to practice using video equipment. B&W is fine for recording therapy sessions, athletic and sports instruction and a myriad of other uses where communication of movement, form, shape and sound are most important.

Portability, reliability and economics are other crucial factors in choosing color or b&w. All late model b&w cameras are highly developed electronically, extremely compact and reliable, produce quality pictures under low-light situations and are almost totally automatic and super cheap ($200-$700).

Although good low-cost ($900-$1,500) small color cameras are now available for home use, they are not quite as compact, reliable and as automatic as b&w cameras because of the color camera's need for correct and adequate lighting. Also, since color video camera technology advances so rapidly, color models are likely to become obsolete much faster than b&w models. Nevertheless, the home color cameras represent a truly remarkable breakthrough in state-of-the-art low-cost video technology. Their compactness, performance and price make them a very desirable addition to any video system, and the choice between b&w and color becomes much easier.

When to Use Color?

Color becomes a necessity if producing tapes for national distribution in a highly competitive program marketplace. Also, product promotion, industrial sales tapes, and certain kinds of training and educational material demand color. Many people find a low-cost b&w system will serve most of their needs, and a color camera can be rented easily when an occasional color production is required.

Mixing B&W and Color

The forward-thinking buyer will purchase as much color-capable equipment as possible if he thinks he may eventually want total color. Color VTRs are only slightly more expensive than b&w VTRs, and they record and edit b&w tapes better than b&w VTRs.

Color monitor/receivers are nearly twice as expensive as b&w monitor/receivers, but usually at least one color monitor/receiver is needed for playback and recording of off-air broadcast programs or purchased prerecorded program tapes. An intelligent mix of b&w and color monitors and color VTRs can provide good present and future flexibility without spending a great deal of money.

HOW TO USE THESE CHAPTERS

Let's get started by examining specific pieces of video equipment, how they work, their inner mechanics, weaknesses and danger signals. Beginning at the very basic levels, we will work toward a greater degree of complexity. If you need to know only about b&w cameras, skip over the color camera part. If you know all about vidicons and plumbicons, proceed beyond that part of the camera chapter to something else. Feel free to stop and start at whatever point your needs dictate.

Chapter 4
The Video Camera

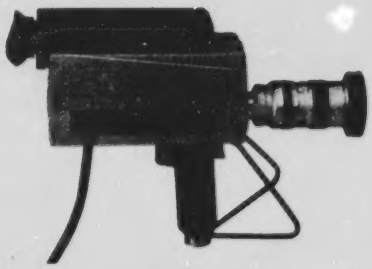
CAMERA TUBES

The electronic or VIDEO CAMERA is similar to any other camera in that light reflected from an image is focused by a lens onto a plane inside the camera. Unlike the film camera, the video camera contains a CAMERA TUBE which processes the image. Types and sizes of video cameras vary greatly, because they must be designed for a variety of different applications. The video camera's use determines the sophistication of the design, the cost and the type of camera tube.

Color Studio Camera

The camera tube plays a major role in determining the light sensitivity of the camera, the sharpness of the picture and whether or not the image will be reproduced in black-and-white (b&w) or color. B&W cameras contain only 1 tube, but color cameras may have as many as 3 or 4 tubes.

Originally, camera tubes were as large as 3 or 4 inches in diameter and required incredible amounts of light to produce good pictures. The evolution of video technology has provided us with the inexpensive and versatile VIDICON TUBE, characterized by good light sensitivity, small size and excellent picture sharpness. Although there are other kinds of tubes far superior to the Vidicon, some tubes cost 10 to 20 times as much as the vidicon's relatively low cost of $70 to $120.



Portable Camera

The Vidicon is the standard tube used with nearly all nonbroadcast closed circuit small format video gear. Variations on the Vidicon include the TIVICON, an extremely low light level tube that uses silicon diodes; and the NEWVICON, a sophisticated low light level tube produced by Panasonic.

One of the limitations of the Vidicon is its inability to deal with very low light level scenes. At low light levels, the image quality will be grainy and an annoying "lag" or ghosting effect will be apparent. Improved circuitry used in post-1973 cameras has allowed b&w cameras to produce fairly good pictures in less than 20 footcandles of light—the equivalent of average household room lighting. A FOOTCANDLE is that amount of illumination falling on a surface one foot away from one candle.

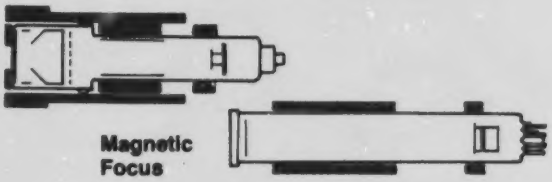
The more expensive Tivicon Tube will produce good pictures in 2 footcandles (a very dark room) and the Newvicon functions as an in-between option with some of the low light sensitivity of the Tivicon but costs less and performs better in regular light situations. The Panasonic Newvicon is highly resistant to burns and typical vidicon tube lag and doesn't turn the picture black on bright background shots. For production purposes, the Newvicon is far superior to the Tivicon. Most standard b&w cameras can be modified to accept the Tivicon or Newvicon tubes at extra cost.

Another common camera tube is the Philip's PLUMBICON (lead oxide) Tube, the standard of the Broadcast TV industry. It is an excellent, sophisticated, low light, high resolution tube and is used in most color broadcast TV cameras. Other high-performance broadcast quality color tubes are the CHALNICON tube, a cadmium selenide design, or the SATICON tube, a tin/oxide/selenium–arsenic/tellurium design. All three of these tubes are available in the 2/3-inch size for use in portable cameras.

The tube's size greatly affects the resolution of the picture. The most common tube size has a 2/3-inch tube faceplate diameter and could be likened to the relative image size as referred to in 8mm or 16mm film. The larger the tube faceplate size, the larger the picture area and the better the picture quality of the image. The 2/3-inch Vidicon is commonly called a SEPARATE MESH TUBE, because it contains a separate screen inside the tube which increases picture sharpness and reduces image lag.

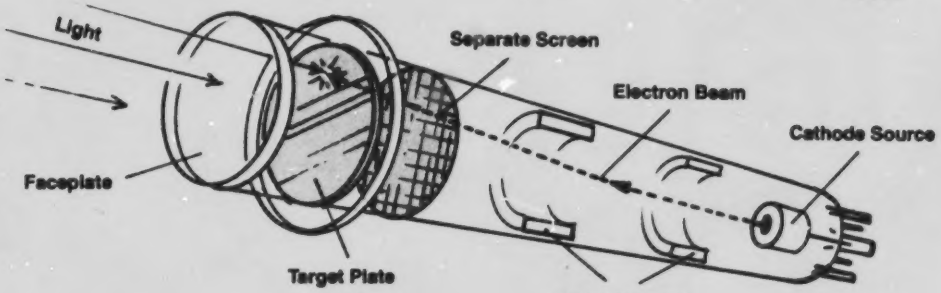
Electrostatic Focus Tubes

Older cameras such as the Sony AVC-3400 or AVC-3200 series utilize the conventional vidicon called the MAGNETIC FOCUS MAGNETIC DEFLECTION type which requires an external focusing assembly to focus the electron beam on the target plate. This external assembly, or focusing coil, needs extra DC power.



Inside The Vidicon Tube

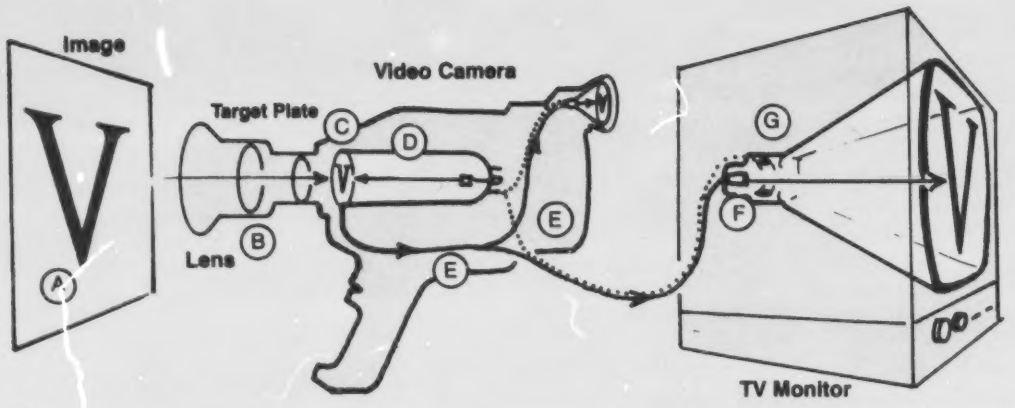
Internal Design



Inside the Vidicon Tube

The light sensitive element of the Vidicon, called the target, consists of a light sensitive transparent electrical conducting film on the inner surface of the faceplate and a photoconducting layer immediately behind the electron gun side. The photoconducting layer changes resistance in inverse proportion to the brightness of the light falling on the target plate. That is, a bright spot hitting the target plate results in less resistance and a higher voltage when the beam sweeps across the spot. Less light results in a lower voltage on the target plate.

The later model cameras such as the Sony AVC-3450 and AVC-3250 & 3260 series cameras, and most b&w Panasonic cameras utilize the ELECTROSTATIC FOCUS MAGNETIC DEFLECTION Vidicon assembly which has internal electrodes within the Vidicon tube itself that focuses the beam. This eliminates the need for the heavy focusing coil which then greatly reduces the power consumption, weight and size of the camera. Some cameras are now approximately the size of a pocket calculator.



The camera tube is basically a TV set in reverse:

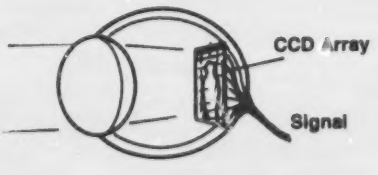
Light is reflected from image *(A)* focused by lens *(B)* on target plate *(C)*. The target is scanned by the electron beam *(D)* produced by the tube and converted into electrical information or voltage and amplified *(E)*. Finally, electrical information passes by wire to the picture tube or cathode ray tube (CRT) in the TV monitor *(F)*. The CRT scans the face of the TV tube in the monitor in step with the electronic information supplied by the camera *(G)*. The image is displayed on the light-sensitive face of the CRT, converting electrical information back into light information again.

CCD Cameras

The camera tube is the main limitation of the camera's size. With INTEGRATED CIRCUITS (IC's) most of the camera electronics can be reduced to a few square inches. RCA sells several b&w cameras that have eliminated the tube entirely and instead use what is called a CHARGE COUPLED DEVICE (CCD). These devices are basically composed of thousands of tiny light sensitive circuit arrays in a grid which can scan a picture. Like other solid state devices, CCD cameras use minimal power, generate little heat and are ultra-reliable and compact.

CCD cameras can include a light-amplifying circuit on the faceplate to greatly improve the camera's low light ability. A Fairchild CCD camera is available that can function in 125 millionth of a footcandle! Noise levels (undesirable picture grain) can be reduced significantly because of the integrated video amplifier design so that contrast ratios of 500 to 1 (similar to film) can be achieved. Soon, the resolving power of the CCD camera will far exceed the best lenses, and the video camera will be 98% lens and 2% electronics. Then we will need to invent electronic lenses. CCD designs currently are being integrated into other video-system components.

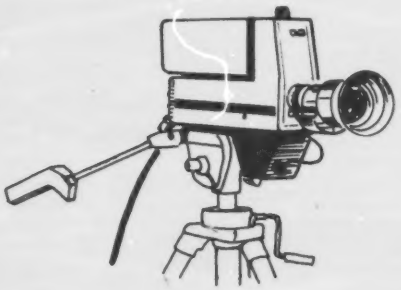
CCD Camera System



TYPES OF CAMERAS

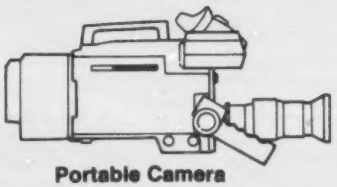
As we've said, cameras are designed to serve a wide variety of purposes. The simplest type of camera consists merely of a body and lens. This is the common surveillance type, usually found inconspicuously guarding book stores, supermarkets and liquor stores in a "1984ish" manner. In order to be usable for production purposes, the camera really needs an electronic viewfinder so you can see the picture you want the camera to shoot. Otherwise you must try to aim the camera by watching it on a monitor, which is somewhat difficult.

Video camera viewfinders are electronic and function like a single-lens reflex camera, in the sense that you are able to see almost exactly what the camera tube sees. The electronic viewfinder is just a miniature TV monitor mounted on the side or top of the camera.



Studio Camera

Surveillance Camera



Portable Camera

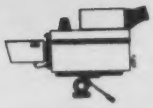
Generally, nonsurveillance video cameras fall into 2 basic categories—portable and studio (nonportable) cameras. Designed to operate on battery (DC) power, portable cameras are lightweight and compact but offer few external adjustments. On the other hand, studio cameras are heavier and bulkier, but offer lots of external adjustments and large viewfinders.

Video Camera Control

The quality of a video program is only as good as the picture the camera puts out. Proper lighting and camera adjustment are essential to a quality video production. All video cameras have adjustment features that can be used to optimize picture quality; some are controllable directly by the camera operator, and others accessible only by taking off the camera housing. Unless you have some background in electronics and/or access to the particular maintenance manual for a specific camera, equipment should not be disassembled. Otherwise, the camera may become even further misadjusted or damaged and require expensive repair.

Internally Controlled Cameras

Some cameras have no external adjustment controls, but have had their electronics preset at the factory for the average shooting requirements. Most hand-held portable b&w cameras are of this type. Typical internally controlled automatic cameras are the low-cost studio or nonportable video cameras. An example is the Sony AVC-3000 and AVC-3200 series cameras—3000, 3200, 3210, 3250, 3260, 3400 and 3450. These studio cameras have detachable viewfinders and are good rugged basic b&w cameras. They usually are purchased in package form which includes Zoom lens, tripod, viewfinder, microphone and carrying case.



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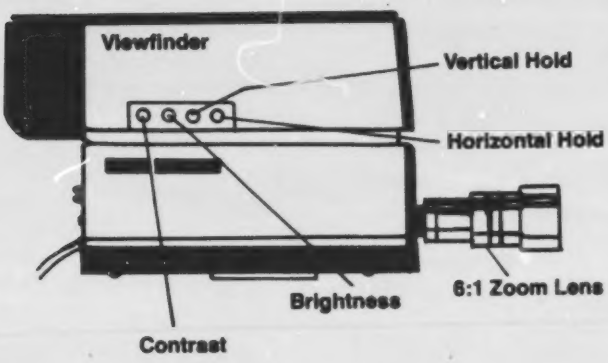
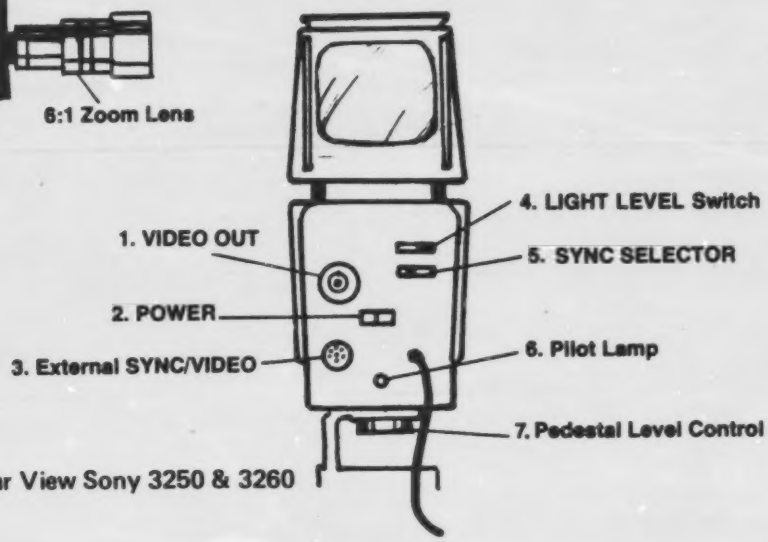
Sony 3250 & 3260

Side View of Internally Controlled Studio Camera



These controls affect the VIEWFINDER ONLY. They do not affect the picture that is being recorded. These controls are like those on any standard TV set.



Rear View Sony 3250 & 3260

Camera Controls

1. *VIDEO OUT*—The picture is transferred from the camera to the VTR or monitor by means of this plug. Connect the camera coaxial cable (RG59-15)—the one with the metal plugs on each end—from the camera to the VTR or the Monitor. Older model cameras, (AVC-3200 and AVC-3210), allow you to go directly to the VHF terminals on a TV set from the VIDEO/RF plug. Make sure you place the VIDEO/RF switch in the RF position. *See Chapter 8, RF Units—TV Monitor.*
2. *POWER* SWITCH—Turns the camera on and off.
3. *EXT*ERNAL *SYNC/VIDEO*—You may use the 6-Pin plug to connect the camera to most Sony ½-inch VTRs, but this is not recommended. Instead, use the camera coaxial cable. The 6-Pin cable with this plug is used mainly to connect the camera to a multiple camera switcher and SPECIAL EFFECTS GENERATOR (SEG).
4. *LIGHT LEVEL* SWITCH—This very handy control allows the camera to be used in low-light situations, although the picture will lose some quality. The low-light mode will allow the camera to work in as little as 1.5 footcandles!
5. *SYNC SELECTOR*—Use INT (internal) SYNC if this is the only camera to be used. Use EXT (external) SYNC if several cameras are to be used and/or if a separate sync generator is being used. In the latter case, the 6-Pin cable is also required.
6. PILOT LAMP—signals that the camera is ON!
7. *PEDESTAL LEVEL* CONTROL—Located underneath the camera, this control is used to match or balance the camera pictures together when using several cameras at once. The pedestal control will affect the shades of gray and contrast levels of the picture.

Evaluation of the AVC-3250 & AVC-3260 Cameras

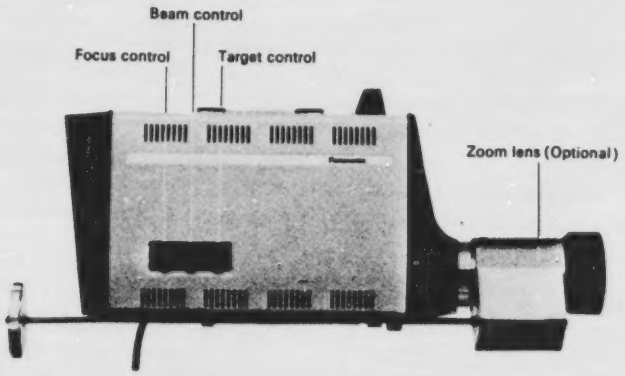
Both of these models are excellent b&w cameras. Their resolution is very good—500 lines at the center in the HIGH LIGHT MODE and 450 lines in the LOW LIGHT MODE. Both cameras are very stable, dependable and are completely solid-state, except for the Vidicon tube. The difference between the 3250 and the 3260 is that the 3260 has 2:1 INTERLACE SYNC which is essential for editing. This feature is well worth the extra $100 if this is your main or only b&w camera, or if you intend to edit the pictures. The DX designation refers to the complete studio ensemble which includes carrying case, microphone, zoom lens and viewfinder.

Typical Externally Controlled Studio Camera—The Panasonic WV-361P

Panasonic has an excellent reputation for low and moderate cost studio cameras—perhaps the best. A variety of cameras are offered with the WV-361P being one of the top of the line b&w model which features high performance and picture resolution, very good low light sensitivity and just about every accessory possible.

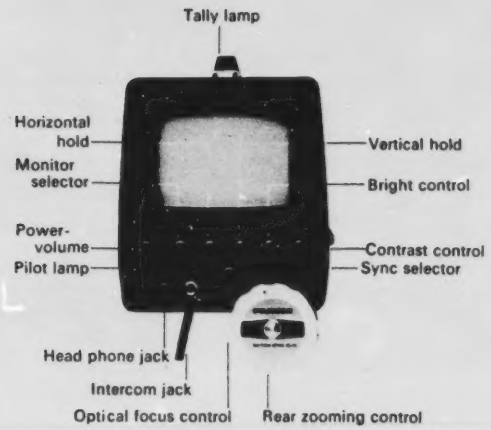
Camera Features:

- 2/3-inch separate mesh vidicon
- Big 6-inch diagonally measured viewfinder
- Viewfinder also functions as a playback monitor
- Picture resolution of 550 lines at center
- Automatic light control compensation of 5000:1
- Automatic/manual target control
- Image blur and ghosting eliminated
- Plug-in 2:1 interlace sync board—optional WJ-120
- Built-in tally, intercom and headphone connections
- Integrated tally light
- Operates on internal or external sync
- C-mount lens
- Will operate in as little as 2 footcandles of light



Side View of Camera

1. *FOCUS* CONTROL—This control adjusts the electronic focus of the vidicon tube. The lens focus, optical focus, target and beam must be correctly set first.
2. *BEAM* CONTROL—This control adjusts the electron beam current inside the camera tube. Turn the control until the picture washes out and then returns to good quality black and whites. Excessive contrast will reduce picture sharpness.
3. *AUTO/MANUAL TARGET* CONTROL—This control adjusts the sensitivity of the camera tube target plate. This circuit is self-adjusting to a great extent, but for maximum sharpness, turn the control until the picture appears and then stop. Increasing the target voltage will produce greater picture contrast but will prematurely wear out the tube and cause greater image lag. It is probably best left in the AUTO mode.
4. ZOOM LENS—A variety of C-mount fixed focus or zoom lenses can be used.

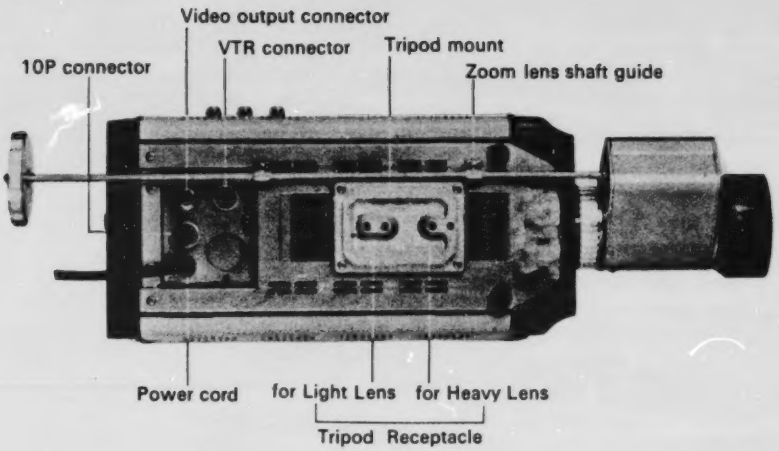


Camera Rear Control Panel

1. TALLY LIGHT—Indicates to the actors that the camera is "on the air."
2. *HORIZONTAL HOLD*—Adjusts the horizontal hold for the viewfinder.
3. *MONITOR SELECT*—A 4 position switch that allows the camera viewfinder to function as a VTR recording monitor and a VTR playback monitor when used with a special connection to a VTR 8-PIN and as a camera monitor or a line view monitor when used with an SEG.
4. *POWER/VOLUME*—Turns the camera on and controls the sound level in the headphones—for audio monitoring when 361P camera is connected to VTR through special cable.
5. PILOT LAMP—Indicates the camera is ON!
6. *HEADPHONE* JACK—Use for monitoring VTR playback with special cable.
7. *INTERCOM* JACK—Plug a 2-way intercom headset in here. NOTE: The camera must be connected to an external intercom system and SEG with a 10-Pin cable. *See page 48—Multiple Camera System Connections.*

   NOTE: On a remote shoot, the 361P can be used as a video and sound playback monitor with any VTR that has an 8-Pin connector. This eliminates the need to carry along a large TV monitor. You will need the special 6-Pin to 8-Pin connector cable however.
8. *OPTICAL FOCUS* CONTROL—This control actually moves the camera tube forward and backward relative to the lens. It is the equivalent of moving the film plane inside a film camera. To properly set, first focus the lens on a subject at infinity (a distance over 50 feet away), then turn the OPTICAL FOCUS control until the picture is sharp. Once the subject has been focused, the lens should be able to FOLLOW FOCUS—stay sharp as the lens is zoomed back and forth on the subject.

   NOTE: The subject cannot change his camera-to-subject distance or refocusing will be necessary. The optical focus can be used for extreme close up shots of an object, even with a zoom lens, but the optical focus will have to be reset for the correct follow focus again.
9. REAR ZOOM CONTROL—This controls the optional rear zoom lens which is a very nice feature to have, but crank type zooms are much smoother than push rod types.
10. *SYNC* CONTROL—Set for INTernal sync if this is the only camera, or EXTernal sync if using an external sync generator and/or SEG.
11. *CONTRAST* CONTROL—Adjusts contrast only on the camera viewfinder.
12. *BRIGHTNESS* CONTROL—Adjusts the brightness only on the camera viewfinder.
13. *VERTICAL* HOLD—Adjusts the vertical hold only on the viewfinder.



Camera Bottom View

Camera Bottom Connections

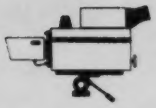
1. POWER CORD—Plug into 120 volts AC.
2. 10-PIN CONNECTOR—Use with a multiple camera system—supplies Video Out, Horizontal and Vertical Sync, Intercom, Tally, and Video Return to camera.
3. *VIDEO OUT*PUT CONNECTOR—A UHF plug used to take VIDEO out of the camera to the VTR or Monitor. Use this plug with a single-camera system.
4. *VTR* CONNECTOR—A 6-Pin plug used for a special cable connection to the 8-Pin plug on VTR. Use for video and audio playback monitoring.
5. TRIPOD MOUNT—For connecting camera to tripod.
6. ZOOM LENS SHAFT GUIDE—Guides zoom lens shaft control.

WV-361P Set-Up Procedure

Read camera instruction manual thoroughly!

Step 1	Turn on the camera and open the lens.
Step 2	Adjust the lens iris for the best light.
Step 3	Focus the lens and adjust the viewfinder controls for the best picture.
Step 4	Adjust the OPTICAL FOCUS for the sharpest picture.
Step 5	Adjust the BEAM and TARGET controls for the best contrast.
Step 6	Adjust the ELECTRONIC FOCUS on the camera side for the sharpest picture.

There are many kinds of video cameras, and the control configurations of each model will vary somewhat. The most common type of studio black-and-white cameras used at the private, institutional and professional level are mentioned. Most cameras will have most of the functions mentioned, although some controls may look different or may be preset and installed inside the camera housing.



NTSC Color System

Essentially, in the American system of TV, color video is just a few things *added* to b&w video, rather than a completely different process as it is in foreign TV systems. Because U.S. manufacturers initiated TV and had produced millions of b&w sets, they had to make the color system compatible with existing TV sets. Otherwise, we would need one TV set for b&w signals and one TV set for color. Unfortunately, having to work with a b&w-based system created restrictions on the development of the American color TV system. The rest of the world recognized the limitations of the American color system and instead designed more advanced and better TV systems for themselves.

The American TV System is officially called the 525-line NTSC System which stands for the NATIONAL TV STANDARDS COMMITTEE OF THE ELECTRONIC INDUSTRIES ASSOCIATION. However, it is often facetiously called Never the Same Color Twice by typically cynical TV engineers. Western Europe uses a 625-line system called PAL, and France, of course, had to have its own system called SECAM, which is also used by the Soviet Union. None of these systems are compatible and video tapes made in the USA will not play back on similar European videotape recorders and vice versa. There are special, very costly transfer processes for changing tapes from one standard to another although the Sony TRIDENT U-Matic VCRs, such as the VO-2630 recorder and the VO-2030 player, will play tapes made on the 3 different foreign standards through a special monitor (PVM-1850). The VO-2630 can record PAL and SECAM but not NTSC, nor can these VCRs transfer a tape from one format to another.

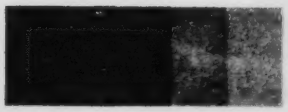
COLOR CAMERAS

The most delicate part of the color video system is the color camera, and it can often be more expensive than the VTR. A low-cost color camera for ½-inch or ¾-inch VTRs will range from $1,000 to $5,000 as compared to $1,000 to $2,500 for the appropriate color VTR. The high price of the camera is due to the delicate nature of the color tube or tubes, the color processing circuitry and initial research and development costs.

The Color Process

Color in TV works through the ADDITIVE color process of combining red, green and blue to form any shade of color in the spectrum. Add red to blue and you have purple, combine green with red, and you produce yellow and orange; and add all 3 together and you get white—electronically. Video cameras sense through these 3 primary colors and combine them to produce all the colors.

In video, we started out in b&w only. So what is black-and-white TV? It's the full range of levels of grays—between black and white. Call that the GRAY SCALE.



GRAY SCALE

Since the gray scale is really an indication of BRIGHTNESS, the technical folks decided to call it LUMINANCE.

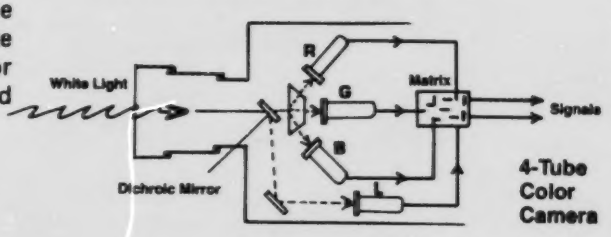
B&W Gray Scale = Brightness = Luminance

If we must add color, we have 2 subdivisions—the shade of the color, called HUE: and the amount of color, called SATURATION or intensity.

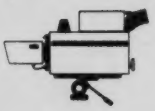
HUE = shade of color, i.e., red or green
SATURATION = intensity of color, i.e.,
high saturation of red = bright red
low saturation of red = dull red

If we combine HUE and SATURATION together we get what's called CHROMA or CHROMINANCE, which we can define as the overall value of the color. If we take away all chrominance information, we are left with our b&w gray scale.

Color video deals with these 2 basic components—the luminance information (brightness) and the chroma information (color). The best way to produce color is to use one tube for each primary color and one tube for the luminance. Thus we have a 4-tube color camera.

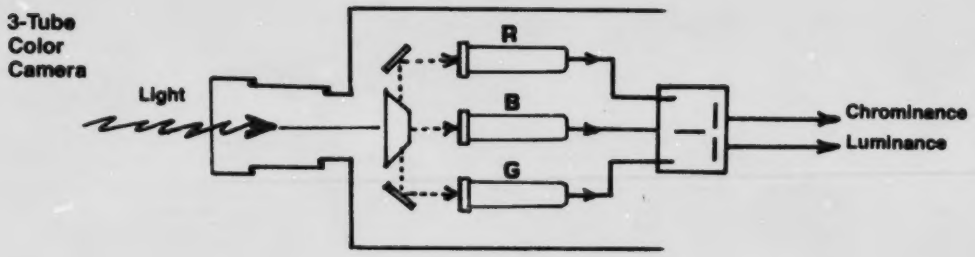


4-Tube Color Camera



The Four Tube Camera

A special device called a BEAM SPLITTER PRISM breaks up the white light from the lens into the 3 separate colors for the color tubes in the camera. The individual color signals from the tubes are then mixed electronically by a MATRIX and added to the luminance signals generated by a separate luminance tube.

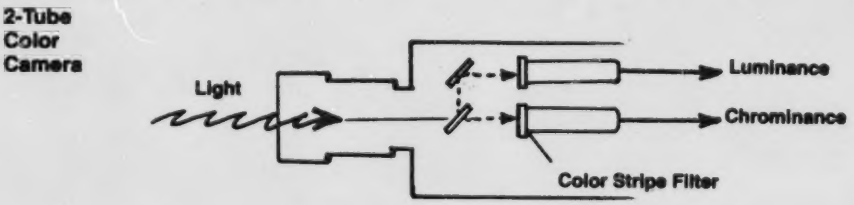


The Three Tube Camera

In this case the luminance is derived from the green color tube. The three- and four-tube systems produce superb color, especially when Plumbicon tubes are used. Most broadcast cameras in the $20,000 and higher range utilize the 3- or 4- Plumbicon tube approach. The drawbacks of such systems are: high cost and complexity, extra electronics and weight, and the necessity to have each tube perfectly lined up with others. This lining up process is called REGISTRATION. If the images sensed by each tube do not line up with each other, the image looks out of focus; has poor color; and will have red, green or blue outlines around it. Registering is a tricky adjustment, so cameras had to be simplified for nonbroadcast users.

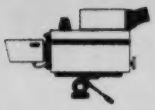
The Two Tube Camera

Some low cost color cameras ($1,200 to $2,700) used the 2-tube system, but it has never become very popular. One tube delivers luminance information and one tube delivers chrominance information.



The single chrominance tube separates the red, green and blue by means of a COLOR DISSECTOR TUBE which uses tiny red, green and blue stripes near the target area to scan each color sequentially. Often this tube is referred to as a STRIPE FILTER TUBE. Still, we have registration problems and the need for extra space to house the 2 tubes and optical mirrors.

Akai and JVC portable cameras use 2-tube electrostatic focusing electromagnetic deflection-type Vidicons placed at right angles to each other. The white light is split into a green component which is processed by a green tube, and the remaining light is processed by a yellow (minus blue) filter in the red/blue tube.

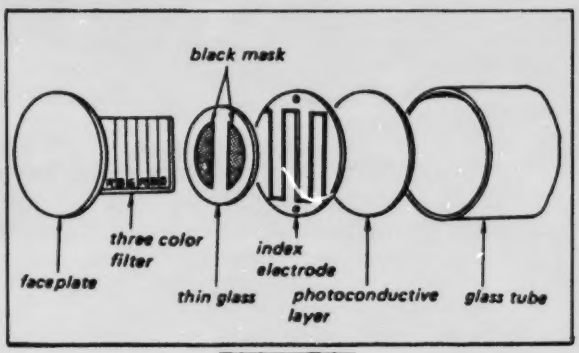


The Single Tube Camera

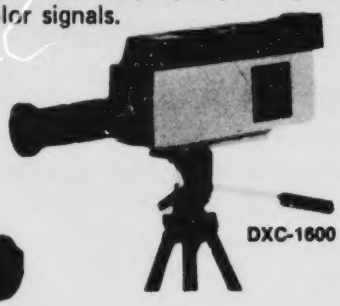
Finally, the single-tube camera was designed to provide maximum simplicity and minimum size. Such designs usually entail a big trade-off, sacrificing color quality and light sensitivity for operational simplicity and weight. This was true of most early single-tube color cameras. Sony, however, managed to create the TRINICON TUBE which uses 3 color filters—red, green and blue inside one tube like other single-tube color tubes but derives the signal from two SIGNAL READOUT ELECTRODES and INDEX ELECTRODES. A full 4.2 MHZ bandwidth luminance signal and the color-coded and reference signals are generated within the tube. The results is a highly stable and faithful color reproduction. As with all single-tube color cameras, registration problems are eliminated, but processing circuitry is more complex. The Sony DXC-1000, 1200, 1210, 1600, 1610 and 1640 cameras incorporate this tube. The 1-inch Trinicon tube, however, still needs more light than a 3-tube Plumbicon camera and many of the other single-tube color cameras. The newer 2/3-inch Trinicon tubes need much less light than the 1-inch tubes. The DXC-1640 uses a 2/3-inch tube.

The Trinicon Tube

The Trinicon tube is a Vidicon tube which uses 280 sets of red, green and blue filters arranged vertically in front of the photoconductive target. The tube delivers both chroma and luminance information to the camera preamplifier. Light enters the tube and is separated into 3 colors by the color filters. The index electrode is used to provide the proper phasing reference for the color signals.



Trinicon Tube



DXC-1600

DXC-1610

Sony Trinicon Cameras

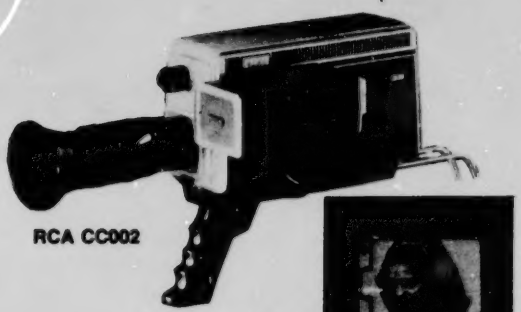
DXC-1210

DXC-1640

Other Single-Tube Color Cameras

In 1978, a whole new array of low cost ($800-$1,500) single-tube color cameras became available which were mainly intended for home video use. These included the remarkable JVC G-series cameras, the Panasonic PK-series, the RCA CC-series and the Hitachi VK-series cameras. Similar industrial versions were also made available.

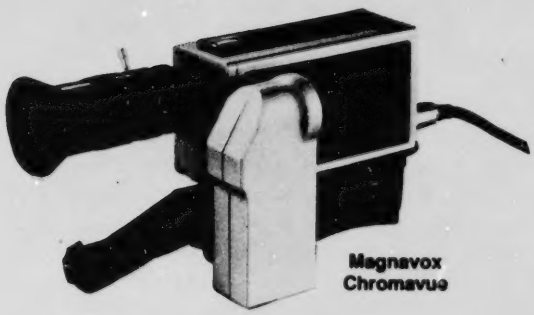
JVC G-71US



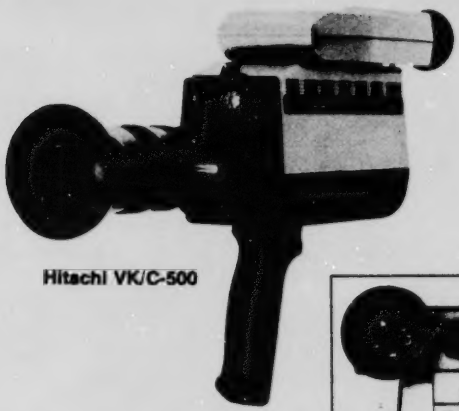
RCA CC002

Light Level Indicator

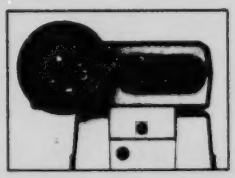
Home Video Cameras



Magnavox Chromavue



Hitachi VK/C-500

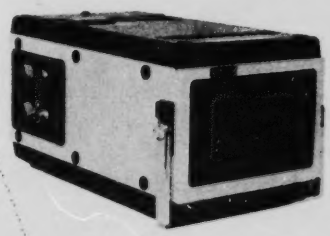


Electronic Viewfinder/Monitor

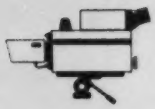
These home color cameras are remarkably compact, lightweight and light sensitive. They will take a good picture in almost standard room illumination. Automatic internal circuitry and ingenious built-in view finder LIGHT-LEVEL INDICATORS insure perfect exposure control. The Hitachi VK-500 camera even incorporates a tiny built-in audio speaker in the electronic viewfinder for picture and sound playback through the camera. All these home color cameras are practical modular designs which allow later addition of optional accessories such as zoom lenses and electronic viewfinders to the basic model.

The Camera Control Unit or CCU

Since cameras are not only more complex but also require more internal controls, more external knobs and buttons, and more light than b&w cameras, some portable models require an auxiliary control box called the CCU or camera control unit. The CCU must always be plugged into the camera for the camera to work and thus represents an extra item that has to be carried along with the camera. The CCU usually contains color processing circuitry, the camera output plugs and adjustments for setting the camera for the prevailing lighting conditions. Since both natural and artificial light have a pronounced effect on color, the camera must be properly adjusted so it will keep the whites white and not produce a brownish, bluish or yellow tint on everything. Choice of color film requires the same care. You must buy indoor or outdoor film, according to your lighting needs.



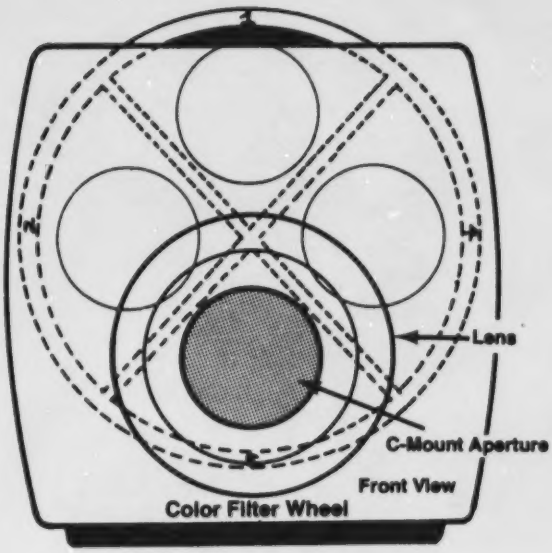
DXC-1600
Color Camera CCU



45

Color Temperature

The color of light is expressed in terms of COLOR TEMPERATURE, usually degrees KELVIN (K). The camera needs to have a color temperature of 3,200° K to produce a correctly-colored picture. 3,200° K is the color temperature of a tungsten light source. Daylight is about 5,600° K. Outdoors this is no problem as there is plenty of light most of the day, but inside you need lights—usually the Quartz variety that are labeled 3,200° K. Certain photofloods are also okay if they are the proper color temperature. Some CCUs will have a switch, selectable between OUTDOORS-DAYLIGHT and INSIDE-STUDIO—3,200° K. Other cameras like the Sony have a filter wheel mounted behind the lens to compensate for the different color temperature environments.



White Balance

As well as setting the correct filter or color temperature switch, the WHITE BALANCE SET also must be adjusted. This control allows the camera to reference itself electronically to what white should look like under the prevailing light conditions. Once the camera knows this, it will keep the colors correct. Usually the White Set must be readjusted every time the camera is moved from one type of light to another, i.e., from indoors to outdoors or shade. Once set for outdoors, it's okay until you want to shoot under Quartz light or in the deep shade. Then you must change filters or color-temperature switch and reset the White Balance.

TYPICAL WHITE BALANCE SET

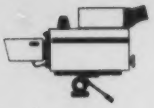
Step 1	Turn camera and CCU to ON position.
Step 2	Point camera at white card or white surface and adjust the lens iris for best picture.
Step 3	Select correct filter for camera or set color temperature switch on CCU for present lighting conditions.
Step 4	Rotate knobs on CCU for maximum white balance reading or push White Set button on camera or on CCU.
Step 5	Remove white card and check colors, especially flesh tones.
Step 6	If colors are incorrect, repeat the white balance process and check for the correct filter on lens.

NOTE: Make sure your monitor is correctly adjusted for correct color.

Lighting Needs

Some color cameras need lots of light! Outdoors is no problem, except in dark shade, but indoor shooting may require 100 to 200 footcandles of light for the best picture. This translates into 3 or 4 of the 700 watt Quartz lights *close* to the subject. This much light can blow fuses and may require lights to be set up on separate circuits. You will need extra extension cords and AC-plug boxes.

CAUTION: Color tubes are expensive, so be very very careful not to burn them by pointing the camera at a bright light. A new Sony Trinicon tube costs $1,000 to replace!!



Studio Color Camera Operation

Panasonic WV- 2100P Camera

So far, we have treated basic color camera design theory. Next, we will evaluate a typical closed circuit studio camera.

The Panasonic WV-2100P camera and WV-8200P CCU was one of the first lower cost automatic color cameras to be manufactured specifically for the budget minded educational/industrial market. Since its introduction, it has experienced considerable internal design evolution. The WV-2100P is a two-2/3-inch Vidicon tube design. One stripe filter tube is used to sense the red and blue colors (chrominance) and the second or green tube senses the luminance component of the picture.

Features of the WV-2100P System Include:

- Simple White Set adjustment
- Gain and pedestal can be controlled automatically or manually on the WV-8200P CCU
- Factory adjusted hue and color levels
- Operates on internal RS-330 sync or external sync
- NTSC composite and noncomposite outputs
- Minimum required illumination is 50 footcandles and optimum illumination is 200 to 250 footcandles.
- Horizontal resolution of 500 lines at center of picture
- 4½ inch viewfinder
- CCU mounts in standard 19 inch rack
- Many optional zoom lenses

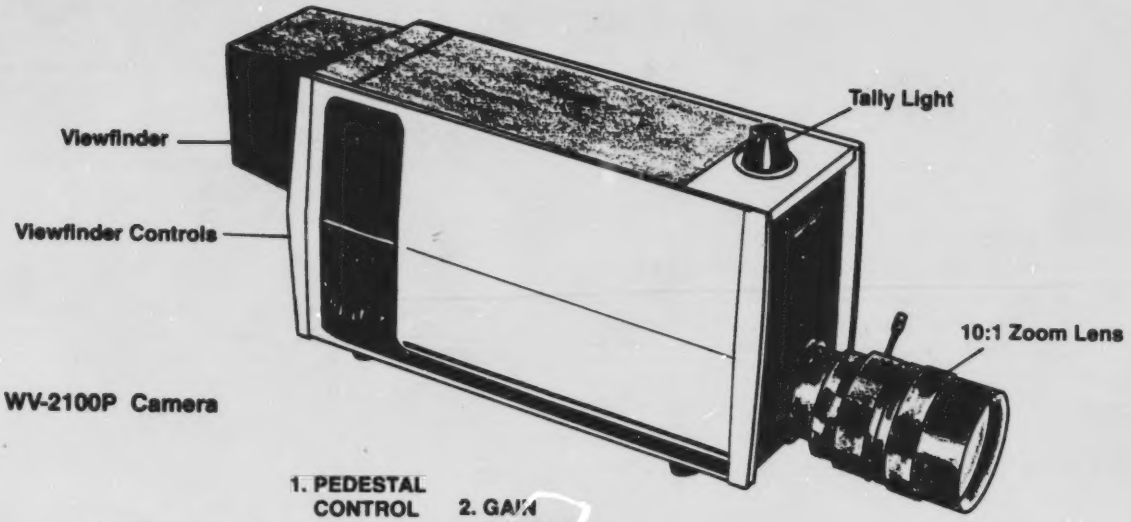
WV-2150 Camera

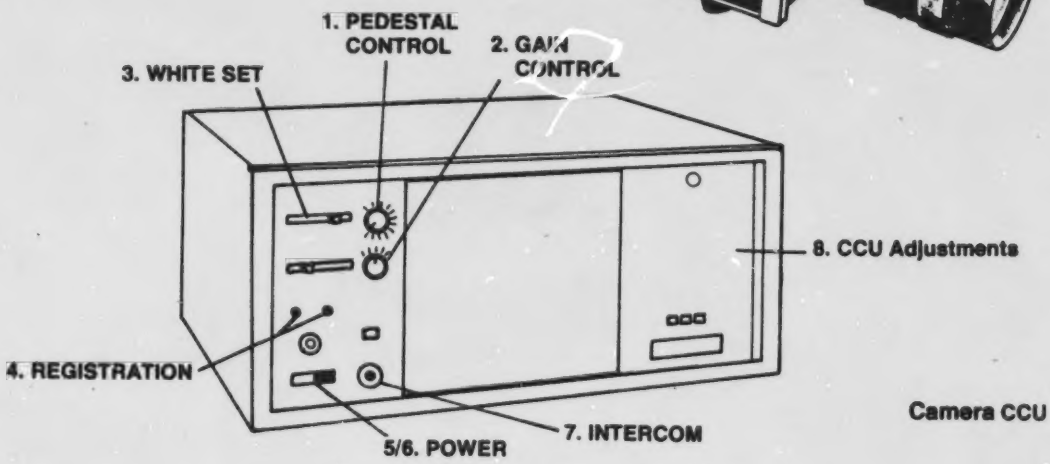
WV-8250 CCU

Improved Model Panasonic WV-2150 Camera and WV-8250 CCU

Special Features of Improved WV-2150 Camera and WV-8250 CCU

- Deluxe studio camera specially designed for use with 2 Panasonic NEWVICON tubes.
  Advantages:
  - No picture burn in
  - No blooming of high brightness details
  - Low lag
  - Tubes designed for low stable dark current
- High sensitivity to light
- Gain control switchable for low-light operation at 25 footcandles
- Improved white balance circuitry to enhance color stability and reduce picture noise (grain)
- Improved picture sharpness and definition
- Easy front panel access to all internal adjustments and test points
- All circuits on easily-removable printed circuit boards
- Internal RS-170 broadcast sync
- Internal color bar generator and tube overscan switch (used for aligning replacement tubes)
- Camera can be 250 feet from CCU with optional cables
- White balance switch located at both camera head and on CCU
- Video playback through camera viewfinder





WV-8200P CCU Camera Controls

1. *TOTAL PEDESTAL* CONTROL, AUTO/MAN—Adjusts pedestal level (level of blacks or contrast in picture). This control would normally be kept in the SET or AUTO mode. Use MANUAL mode to match several cameras together.
2. *TOTAL GAIN* CONTROL, AUTO/MAN—Adjusts gain or video level of picture. This control normally would be kept in the AUTO mode.
3. *WHITE BALANCE* CONTROL—3 position switch. Sets camera white balance.

4. *REGISTRATION*—HORizontal and VERTical. Technical adjustment for lining up the picture elements for maximum sharpness. See camera operating manual.
5. *POWER* INDICATOR—Indicates power is ON.
6. POWER *ON/OFF* SWITCH
7. *INTERCOM* PLUG—Plug communication headset in here.
8. CCU Internal Adjustments—Panel opens for technical adjustments to internal CCU electronics.

CAMERA SET UP PROCEDURES

Color Studio Camera Set Up

Be sure first to read through the camera operating manual!

Step 1 **Connect camera to CCU** with multi-pin cable and plug in intercom headsets.

Step 2 **Connect CCU to VTR** or Monitor. Plug camera into SEG for multiple camera operation.

CAUTION: CAMERA MUST BE PLUGGED INTO CCU FIRST—BEFORE TURNING CCU ON! OTHERWISE PRE-AMP CIRCUITS WILL BURN OUT!

Step 3 **Turn the CCU ON** by pushing the power switch. The indicator lights should illuminate on both the CCU and camera head.

Step 4 **Turn ON the studio lights** and obtain correct level of illumination—150 to 250 footcandles. Open the lens iris and adjust for best picture. Focus the lens.

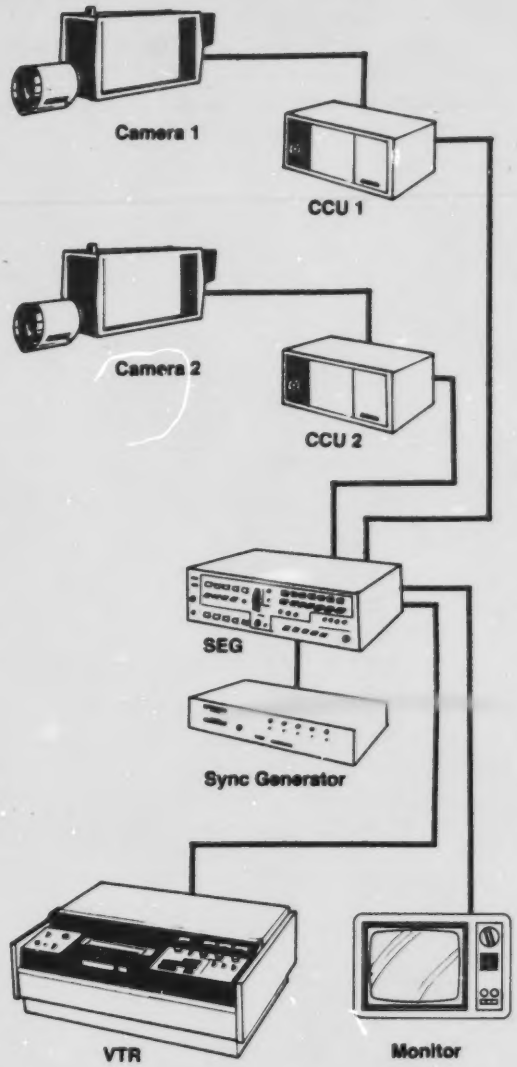
Step 5 **Set White Balance**—First set up a large card divided between black and white and focus the camera on the card so the camera picture is ½ black and ½ white. Next, place the white balance control on the CCU in the SET mode, then switch it to the HOLD mode. The correct white balance should now be obtained. Remove the black and white card and check the camera picture for correct flesh tones and colors.

If the White Balance Control does not result in proper color tones:

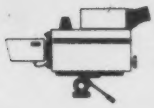
- Check lights for proper color temperature (3,200° K)
- Make sure color monitor is properly adjusted for correct color
- Check for proper level of illumination (150-250 footcandles)
- Check for proper GAIN and PEDESTAL level control adjustments
- Reset white balance

Step 6 **Set GAIN CONTROL** in the AUTO (Automatic) mode. The camera now should be properly set up and should not require any additional adjustments unless the lighting is substantially changed.

Multi-Camera System



White Balance Chart



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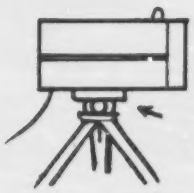
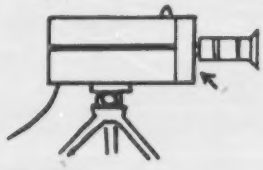
General Camera Set Up

It is always a good idea to follow a precise and specific set up procedure when operating any video equipment. This will minimize errors and damage to the equipment. There are many things that can go wrong with even the simplest video set up, so it's best to use procedures that anticipate possible problem situations.

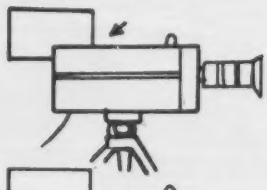
Step 1
Fasten camera body *SECURELY* on the tripod.



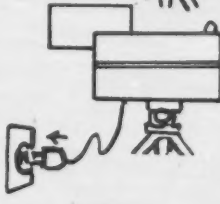
Step 2
Carefully mount the lens on the front of the camera.



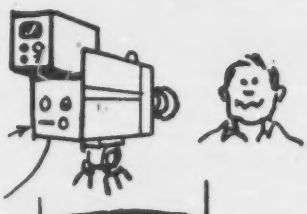
Step 3
Attach the viewfinder (if not built-in) to the camera.



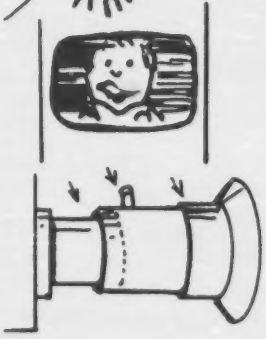
Step 4
Plug in the camera power cable.



Step 5
Turn the camera on and let it warm up.

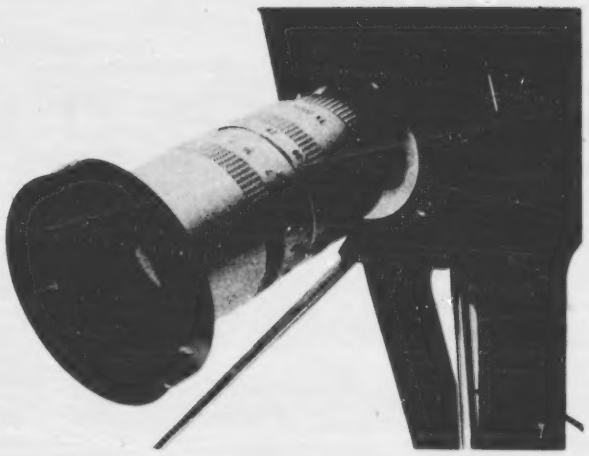


Step 6
Remove lens cap after 60 seconds or so and the picture should appear.

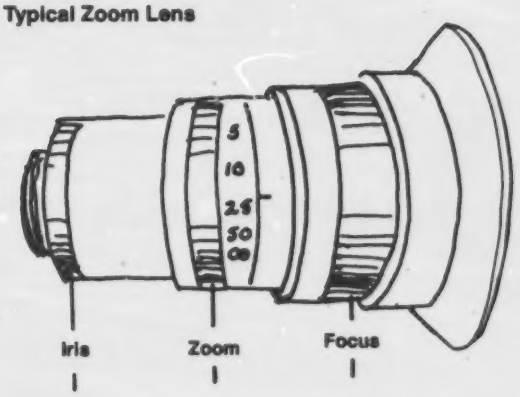


Step 7
When the picture appears, adjust the lens.

LENSES



Typical Zoom Lens



NOTE: First make sure the CONTRAST and BRIGHTNESS controls on the camera viewfinder are properly set, then judge the actual camera picture output.

Lens Principles

The "f" stop or IRIS (A) controls the amount of light entering the camera. The smaller the "f" stop (for example, f-8 or f-11), the sharper the picture or the greater the DEPTH-OF-FIELD. The depth-of-field is that amount of the picture area that will be in focus at a particular f-stop. The larger the f-stop, i.e., f-2.8 or f-1.8, the less the depth-of-field or that amount of the picture area that will be in focus. Usually, it is best to have as much area in focus as possible.

Since a video picture tends to lose contrast when shooting at a small f-stop (i.e., f-11 or f-8), one must compromise between obtaining good contrast and depth of field. Generally, a picture is more pleasing and will copy better if it has good contrast. Sharpness is secondary unless the picture is grossly out of focus.

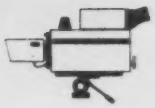
Lens Operation

Open the IRIS (A) for the best light. Turn the ZOOM RING (B) to maximum magnification (full close-up or telephoto). Next, turn the FOCUS RING (C) until the focus is sharpest. Now it should be possible to zoom back (wide angle) with the focus control and the picture should stay in focus while zooming, provided the camera to subject distance does not change.

If focusing is attempted at less than full zoom or telephoto, the object will go out of focus when zooming in later. On cameras having a rear mounted mechanical focus adjustment, the mechanical or optical focus first must be properly set, otherwise the zoom lens will not focus correctly when zooming.

Focus

Zoom Back



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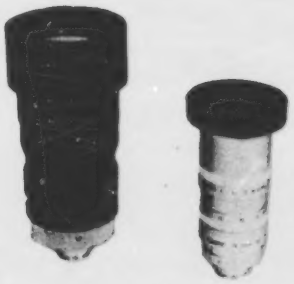
Different Types of Video Lenses

Lenses play a crucial role in determining the quality of the picture image. If the lens is faulty, inadequate or the wrong kind for your camera or tube, the potential image quality of the camera will be seriously compromised.

The lens may be a FIXED FOCUS (single-magnification type) such as a wide-angle, telephoto, or standard size, or it could be a ZOOM LENS which allows various ranges of magnification.

Fixed Focus Lenses



Zoom Lenses

In video, fixed-focus lenses are rare except for those found on basic surveillance cameras. Zoom lenses, which have much greater flexibility than fixed focus lenses, now have evolved to the point where they have excellent resolution and contrast characteristics equal to or surpassing many fixed-focus lenses.

Most production video cameras either come with a 6:1 or 10:1 lens and have the capability to use a very wide array of optics. 6:1 or 10:1 is the *range* of focal lengths in a given lens. Because a production TV camera must be able to follow moving action and produce a variety of shots, the use of a zoom lens is almost mandatory.

Companies such as Canon manufacture an 18-108 mm f-1.6 lens and a 15-150 mm f-2.0 lens for 2/3-inch tube cameras. Angenieux also makes a 9.5-143 mm f-1.8(15:1)lens with MACRO or close-up focus ability. Other manufacturers such as Schneider, Fujinon, Tamron, Cosmicar and others make a wide variety of lenses for both 2/3-inch and 1-inch tube video cameras. Unfortunately, super zooms are really heavy—6 or 7 pounds for a 10:1 lens, which may double the weight of a hand-held camera. Big electric 20:1 zooms for broadcast cameras can weigh as much as 60 pounds!

The C-Mount

All black-and-white and most color cameras use a standard C-MOUNT or 16 mm screw-in type lens thread, so most video lenses will fit on most video cameras. Be careful what lens you use with your color camera. For example, some C-Mount lenses will not work optically even though they will fit physically. This is due to the differences in the length of the optical light path inside the color video camera. Only lenses designed for a particular length of light path or BACK-FOCUS distance will work correctly. Because of this, many film and other video lenses will not work on certain cameras unless the cameras are modified, which is not generally a good idea.

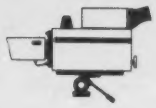
Since what you actually see is the picture you will get, try out various lenses on your camera before you buy anything. Point the camera at a subject with fine lines in it, such as a building with bricks and check the camera's picture for the number of fine lines you are able to read. Try the same test with other lenses to judge which ones are the best for a particular camera.

Sony Trinicon C-Mount Lenses

Even though the Sony color cameras use a standard C-Mount, the focal plane of the Trinicon tube (where the picture focuses) requires specially-constructed lenses. Conventional C-Mount lenses will produce VIGNETTING, or circular black shadows around the edges of the picture, because the focused image does not sufficiently cover the face of the camera tube. Several available zoom lenses are designed specifically for the Sony cameras.

Lenzar Optics Corp. manufactures 6:1 and 10:1 lenses that offer a wider angle of 56° and a faster speed (f-1.8 vs. f-2.5) than the conventional Sony lens. Prices range from $1,250 to $2,000.

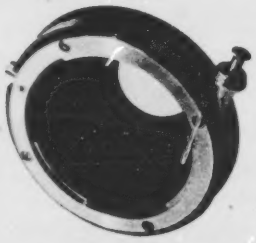
Address: Lenzar Optics Corp.
210 Bryant Road
Lake Park, Florida 33404



Canon and Tamron also make f-1.6 MACRO (close focusing) 6:1 and 10:1 lenses for the Trinicon camera and these are priced from $800 to $1,000.

C-Mount Adaptors

Since most common video cameras use the C-Mount lens thread, adaptors can be purchased to convert both Nikon 35 mm and Pentax-type lenses to the video cameras. The adaptors cost from $15 to $40, depending on the construction and type. Since the 2/3-inch vidicon tube is approximately equivalent to the 16 mm size image, the 35 mm lenses will cause a telephoto effect. Doubling of the 35 mm lens magnification will result when used on a 2/3-inch Vidicon tube camera.



Nikon To C-Mount Adaptor

Lenses and Lighting

Lighting also plays a key role in the performance of a lens and hence the picture quality. The more light you have, the better the picture will be resolved by the lens. Slow lenses (f-2.8 or f-3.5) will need much more light to produce a picture comparable in quality to one produced by an f-1.6 lens in less light. For very low light situations, Cosmicar, Ampex and Angenieux have an f.95 25 mm fixed-focus lens that seems to pull a good picture out of very low levels of lighting. It's really amazing!

Wide-Angle Lenses

Wide-angle lenses are definitely an underdeveloped video resource. Cosmicar has an 8.5 mm fixed focus lens and there is even a 4.5 mm fisheye lens available that is used primarily for surveillance. Like any optical effect, wide-angle lenses should be used creatively and tastefully when they can add impact to the program. Wide-angle lenses are invaluable for shooting in small rooms and are usually very fast and require little or no focusing. Unfortunately, most C-Mount wide-angle lenses *will not* work on most color cameras even though they might fit physically. The

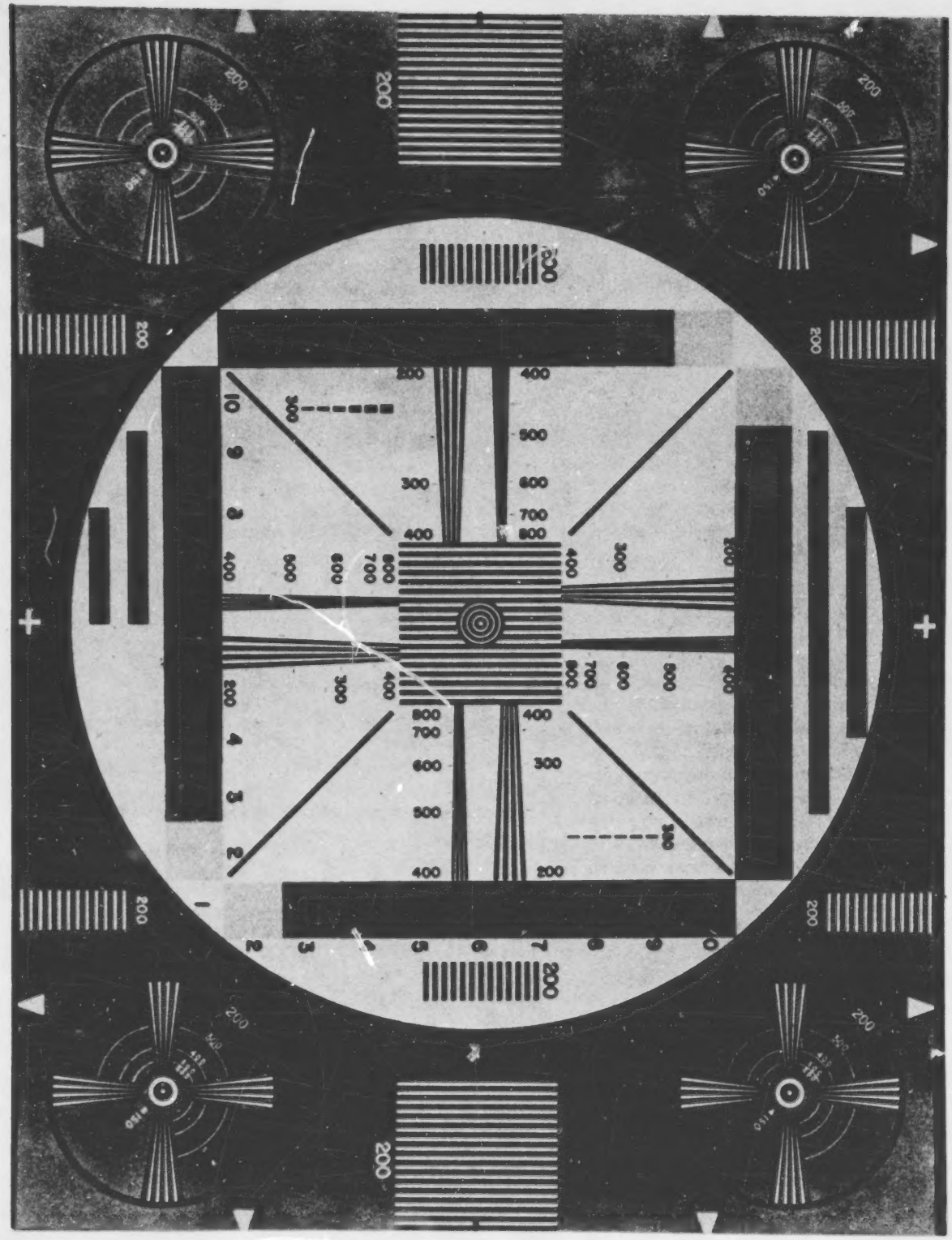
Lens with C-Mount Adaptor

color produced by the camera tube is adversely affected if the lens is not designed specifically for the color camera tube used in that particular camera.

Camera and Lens Resolution

Camera quality is defined in terms of the camera's ability to resolve the greatest number of lines in both horizontal and vertical planes. A special camera-resolution chart is used as the standard for evaluation, much like an eye chart employed to measure a person's sight.

The chart is available from:	Ask for:
Electronic Industries Assoc. Engineering Dept. 2001 Eye Street NW Washington, DC 20006	RETMA Resolution Chart and paste-on Gray Scale The price is $10


200
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The chart is designed so that any given camera must be the same distance away from the Chart. The camera must be lined up so that the arrows in the corners of the Chart correspond to the edges of the camera picture. The camera is then set up and sufficient light used to enable the lens aperture to be opened to f-.8 while giving a good quality picture. The Chart is then read on the camera viewfinder or monitor for the greatest number of lines that can be distinguished clearly on the Chart's special wedges. This then determines the camera's resolution

Because the scanning pattern of the camera tube is horizontal, manufacturers generally rate their cameras according to HORIZONTAL RESOLUTION, since the resolution in the horizontal plane will be better than the resolution in the vertical plane. Also, resolution at the center of the lens will always be better than that at the edges. The standard low cost b&w closed-circuit TV camera, or portapak camera, will resolve 400 to 500 lines in b&w and low-cost color cameras will resolve 250 to 300 lines in color. Better broadcast quality 3-tube cameras will resolve 400 to 500 lines in color.

When choosing cameras always compare the resolution ratings. Resolution is also a function of the size of the camera tube, since the larger the tube, the more lines it can resolve. A 1-inch Vidicon tube will produce sharper and better pictures than a 2/3-inch Vidicon, if they are of the same technological level. In addition, resolution always will be greater in b&w than in color. This is due to the difficulties in registering the multiple color images.

Choosing a Lens

The lens that comes with your camera may not necessarily be the best for optical quality, zoom range, speed or physical operation. You may want to explore the possibility of purchasing other zoom or fixed-focus lenses. If so, there are certain key questions to ask yourself:

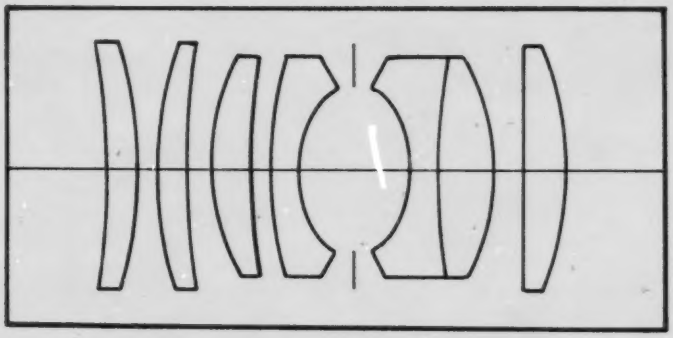
- Is the lens sharp at various light levels?
- How good is the contrast and resolution at both the edges and the center of the picture?
- Can the lens focus on a close-up subject?
- Is the wide angle of the lens wide enough?
- Is the zoom range sufficient for most of my production purposes?
- Is the lens fast enough for my purposes?
- How about the lens' mechanical operation? Does it require me to awkwardly reach around the front of the camera to operate the lens? Does the pushrod work poorly on zooms? Would a crank type or electrical zoom be a better investment?

Trade-Offs

Sometimes you may have to make trade-offs such as increased zoom range for lens speed. You may want an ultra-wide-angle lens or a faster speed, and in this case might have to buy a single fixed-focus lens. Often slower lenses have better optical characteristics than faster ones and are much less expensive.

The Need for Creativity

Unlike film makers, video program producers have traditionally neglected the creative use of lenses and lighting for dramatic effect. Unfortunately, the tendency has been merely to turn on the lights and shoot rather than to take the time to try various lenses and creative lighting. Lenses should be matched with the situation. A wide-angle lens can exaggerate perspective and be particularly effective in close physical contact scenes or in situations where bizarre contorted images are desired. Telephoto shots will compress and flatten the image, also producing interesting subject emphasis. The depth-of-field is increased by a wide-angle lens and reduced by a telephoto lens. Use of different lenses greatly increases the options for securing images.



Dramatic lighting is also an often ignored resource, mainly because many color cameras require a lot of light and frequently perform poorly in less than optimum illumination. However, newer more sensitive cameras now make it possible to create a variety of moods and dramatic effects that will greatly enhance the color and overall impact of the production scene.

The Future of Lenses

With the advent of new camera designs and the need for increased versatility on remote locations, lenses constantly are being designed to be faster, have greater zoom ranges, retrofocus ability and improved sharpness and contrast characteristics. The weight must be reduced without sacrificing lens quality and speed. Fortunately computers are employed to analyze prospective lens designs and can plot the thousands of rays of light passing through the lens in minutes, whereas these calculations might take an optical designer years.

New optical materials should play a key role in improved video lenses. CCD cameras in particular will demand an entirely new approach to lenses because conventional optics severely limit the size and weight characteristics of such cameras. Exciting new technology soon should be forthcoming in this area.

Light Sensitivity of Video Camera Tubes

The camera tube is extremely sensitive to light. That is its job. It does nothing else. With time and use, the tube eventually loses its ability to respond to changes in illumination. It then must be replaced. Assuming the camera is adjusted properly, the usual signs of wear are increasing image lag or retention, poor focus, or permanent black spots in the picture, and therefore, replacement is indicated. Prolonged exposure to white cards or bright lights can prematurely shorten a Vidicon's life expectancy.

Cleaning the Camera Tube and Lens

ALWAYS TURN OFF THE CAMERA WHEN CLEANING!

NEVER TOUCH THE LENS SURFACES OR VIDICON TUBE WITH FINGERS!

Sometimes black spots will appear in the picture due to dirt on the lens elements or on the face of the Vidicon itself. To remove, first try cleaning the glass on the front of the lens. Next, unscrew the lens and carefully clean the glass on the back of the lens. Use any standard lens-cleaning tissue or a can of compressed air (available from any photographic store).

To clean the Vidicon, first remove the lens by unscrewing it from the camera body. Use a Q-tip moistened with lens cleaner fluid to clean the surface of the camera tube. Tilt the camera sideways to reflect the light so the surface of the tube can be checked for dust spots, hairs or other foreign material. Use the bottled compressed air to blow off the dust specs on the face of the tube.

CAMERA CARE

CAUTION: Always keep lens cap on and lens iris in "C" or CLOSED position. Even if the camera is turned OFF, a bright light can burn the tube resulting in a permanent black spot or streak.

NEVER leave a camera pointed at a bright surface very long or expose it to the sun, reflections on water, or other reflective surfaces. Chrome auto bumpers are notorious Vidicon killers. Move camera from side-to-side occasionally to keep the images from "burning in."

NEVER store the camera in a face-down position as this will cause deposits inside the tube to settle inside the tube faceplate, creating annoying black spots in the picture.

AVOID mechanical shock and high ambient temperatures (140°F - 60°C). NEVER leave the camera in an exposed car on hot days.

If black spots or lines persist in the picture after the Vidicon has been cleaned, try cleaning the camera viewfinder too. If spots still remain and do not move when cleaning, they may be small burns and may go away in a few days or weeks. If not, the spots are probably burns or flaking deposits which fall down inside the Vidicon tube and land on its faceplate. With reasonable care, video cameras should last a long time—2 or 3 years of heavy use or 3,000 to 5,000 hours—and require little or no repair.

If the Vidicon does get burned and black spots persist a week later, a last resort method can be used to minimize or eliminate obnoxious burns. Point the camera at a white card that is brightly illuminated by either the sun or the studio lights. Defocus the camera lens and allow the camera to remain turned on and pointed at the white card for a prolonged period of time (15 min. to 1 hr.). Check to see if the burns have disappeared. This method uniformly burns the Vidicon tube permanently and consequently shortens its life and sensitivity. Tube burning should only be used if a new Vidicon cannot be obtained.

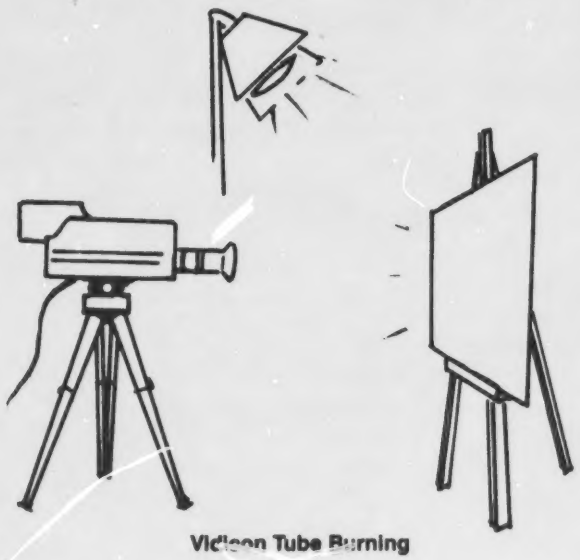
Selecting a Camera

Price is the best place to start. How much can you afford? $200 or $20,000? Obviously, there is a relationship between price and quality, but if you have a good idea what your production needs are and you carefully examine the features of particular cameras in different price ranges, you should be able to find a camera at the right price that will accomplish what you want.

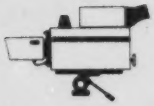
When selecting cameras, keep in mind the ability of the persons available for operation and technical maintenance. Most newer black-and-white cameras are virtually totally dependable technically, idiot-proof, and can be operated by just about anyone. $2,000 to $5,000 color cameras are definitely more complex technically, require care in handling and operation, but are almost as automatic as black-and-white cameras. Color cameras have more buttons to push, cables to plug in, boxes to carry, and need more light than black and white cameras.

The next jump is to the $15,000-$35,000 hi-performance 3-tube cameras which have many automatic features and are actually more compact and in some cases require fewer external adjustments than the less expensive color cameras. BUT, these cameras usually demand a $20,000 per year *skilled* video technician to keep them tuned and producing optimum pictures. They can turn out incredible picture quality, but don't expect a VW mechanic to be able to properly tune a Ferrari.

The first big decision to be made when purchasing a TV system is whether to buy portable or studio type cameras. Either choice usually requires substantial trade-offs because you have to choose between the physical flexibility and mobility of the portable camera and the better control and quality of the studio camera.



Vidicon Tube Burning



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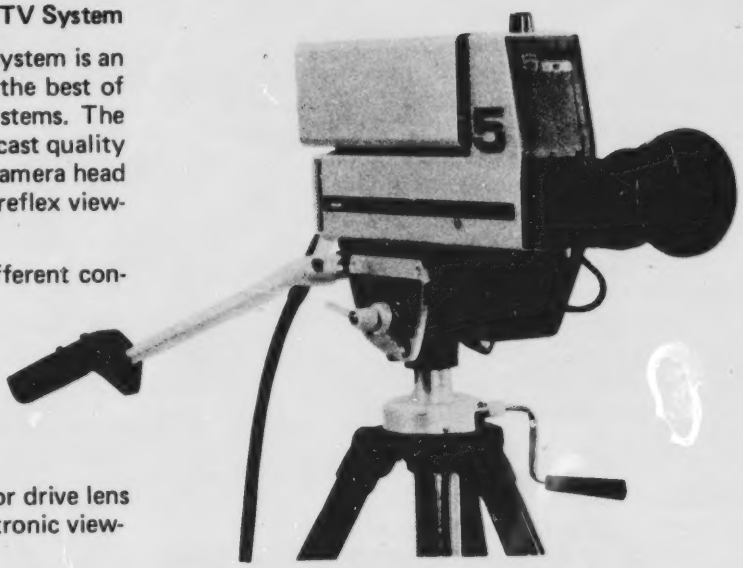
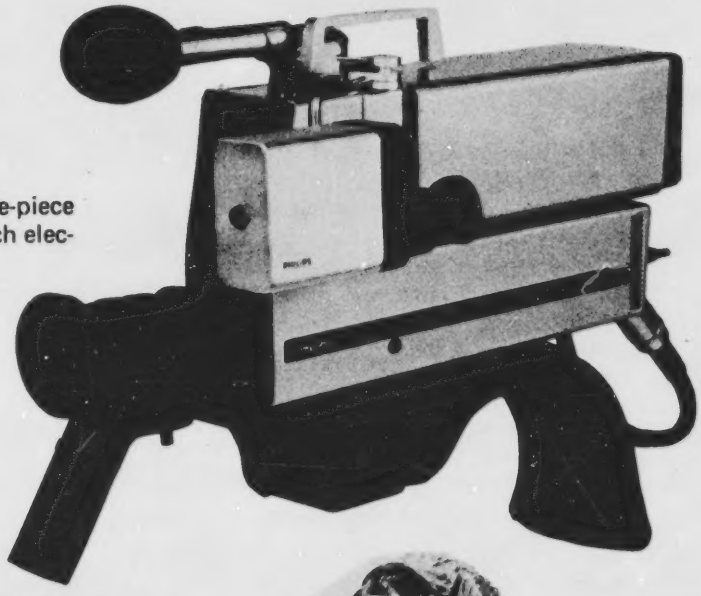
The Philips Video 80 Modular Color TV System

The PHILIPS VIDEO 80 modular system is an innovative new design that provides the best of both studio and portable camera systems. The Video 80 system evolved from a broadcast quality modular camera head. To this basic camera head can be added a variety of electronic reflex viewfinders, lenses and accessories.

The camera can be set up in 4 different configurations:

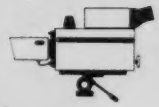


1) as a *studio camera* with a 10:1 motor drive lens and 4½-inch adjustable direct electronic viewfinder.

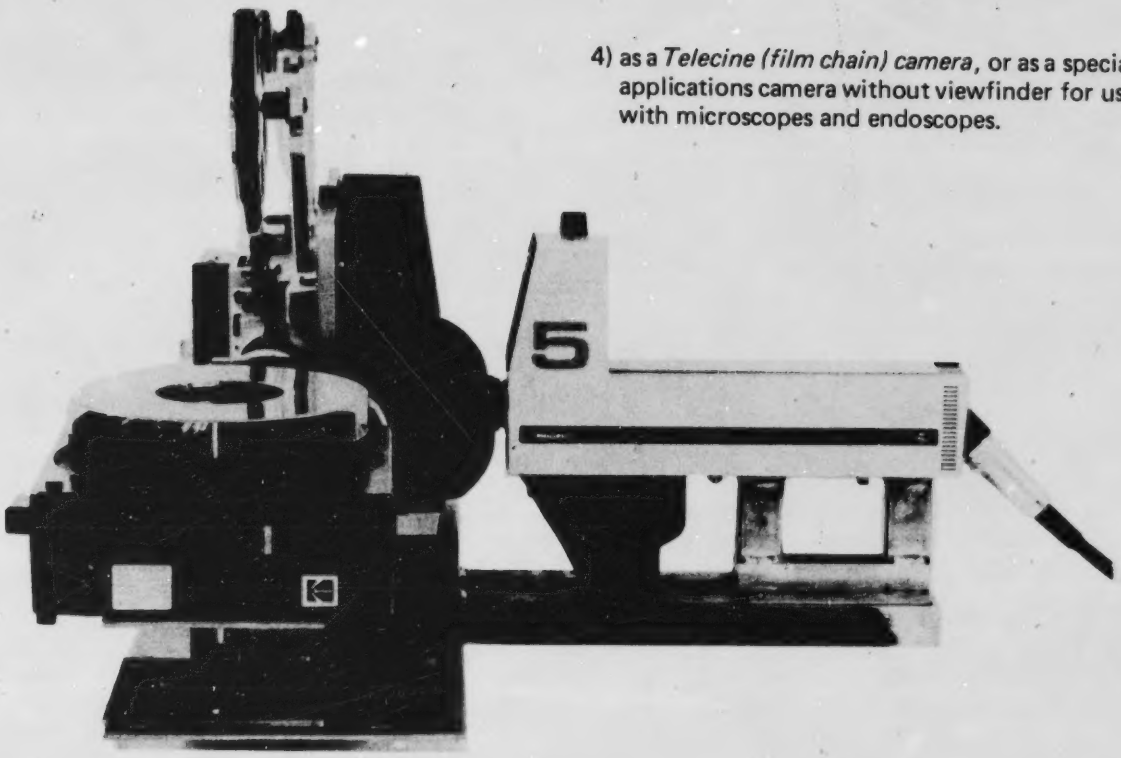


2) as an *ENG camera*, a self-contained, one-piece system with a 6:1 zoom lens and 1½-inch electronic viewfinder.

3) as an *EFP (Electronic Field Production) camera*—a 2-piece system with 4½-inch reflex electronic viewfinder, and camera remote control unit and video mixer.



4) as a *Telecine (film chain) camera*, or as a special applications camera without viewfinder for use with microscopes and endoscopes.



Complete camera set-up in any configuration is simple and requires no tools or special set-up equipment. Minimum checking and adjustment can be done by non-technical personnel.

Philips also provides a complete modular design TV support system for the Video 80 camera. A 3-camera remote control unit, video mixer, monitors, microphones, dollies, stands, headsets, etc., are available.

The really significant advantage of a modular system approach is the ability to start with a basic single camera, and adapt it to a variety of different applications without having to purchase a second camera. As a user's needs change, he need only buy the appropriate viewfinder and adaptor modules. The Philips system is good because it's a high quality system designed for maximum simplicity and ease of operation. The Philips Broadcast Equipment Co. is one of the oldest and most experienced companies in the field of top-quality TV camera design and manufacturing. The Video 80 System will greatly simplify the process of television production.

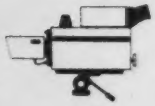
Other Noteworthy Features of the Video 80 System are:

Camera

- Excellent light sensitivity (5 footcandles) and high signal-to-noise ratio (49 db).
- Broadcast quality picture
- Simplified 3-tube RGB system
- Built-in microphone circuit
- Two-way intercom between camera and external source
- Available in NTSC, PAL and SECAM TV standards
- Wide choice of tubes—uses 2/3-inch Plumbicon, Vidicon, Newvicon, Chalnicon or Saticon tubes

TV Support System

- Full remote control of camera
- System components interface with all current audio and video products
- Built-in nontechnical automatic line-up controls
- 4-way video switcher and special effects generator



Factors to Keep in Mind When Buying a Camera Are:

PICTURE QUALITY—Compare the technical specs, video signal to noise ratio (the higher the better—40db to 55db), light sensitivity, image resolution, warm-up time, internal stability and automatic circuitry.

UTILITY—Compare weight, portability, ease of operation and set up, practicality of physical design, ability to interface with various VTRs, lens interchangeability, audio, intercom, tally features, accessories, transportation cases and power needed (if portable). Do you want an internal or external CCU?

LIFE EXPECTANCY AND COSTS—Analyze initial purchase cost and annual maintenance costs. Don't forget cost of tube replacement, spare parts, down time repair/labor rates and possible resale value.

Check 'Em Out!

Use the spec sheets as a starting point, but do not believe it when the salesman says, "Mr. so and so easily chose the AWAKKA XP-7000 over the SAWNA ZAP-2219 because the color was so much better." What one person thinks is good color may not be pleasing to another. So go see for yourself and compare cameras under IDENTICAL lighting conditions if possible.

Also, don't forget to check the camera's low light capability. Does it get really noisy and/or do the colors shift or fade substantially? Make tapes of the pictures recorded by several cameras and use the tapes for later comparison and reference when trying to make your decision. Keep in mind that dealer's showroom conditions are always "ideal," that colors they set up are simple and bright, and lighting is perfect. It's also very hard to remember what a camera's pictures looked like two weeks ago. So make those sample tapes.

The Camera is the Eye

The video camera is the eye through which we interpret our shooting environment or scene. The camera only sees what we want it to see. But also we may be limited by the camera's technical viewing ability, especially in color. The video camera then, is a very important link in the video system. The camera's picture quality and the operator's creative and technical skills determine what will be recorded on the VTR.

Camera technique can be a very personal matter. Different individuals will soon develop their own style of perceiving or interpreting a scene. Like anything else, good camera work comes with practice. Try different lenses and angles, and experiment with camera motion. If the subject can not move, move the camera around him. Hand held or shoulder mount cameras do permit considerably more camera mobility than big bulky studio cameras.

Generally camera movement looks much more professional if it is steady and smooth. Zooms and pans should appear planned, deliberate and fluid. Use a good fluid-head tripod. Wide-angle lenses will require the camera operator to get in close to the subject to produce a good picture. Don't be afraid to move up close unless it seriously disturbs the scene or the people.

Because the TV screen is so small, a close-up image that fills the scene will have more impact than a long shot which reduces the size of the image to a few inches. Composition, or placement of the images and their relative sizes, is important to the impact of the scene as is the continuity or flow of action through the scene. It will be well worth the effort to read any of the fine books on film and video camera technique and esthetics. A skilled camera operator can bring real life, excitement and interest to an otherwise dull production.

We can now turn our attention to the next step in the video process—how pictures are actually recorded on tape.

Chapter 5
The VTR

Quadruplex and Helical Scan Recording

As we've mentioned, the largest VTRs may be the size of two refrigerators and could cost $200,000 or more. These are the big QUAD format machines that use 2-inch wide videotape and produce the best quality color pictures.

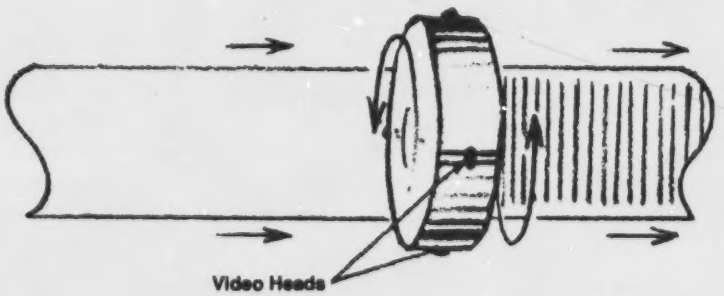
Quad or QUADRUPLEX VTRs reside mainly in TV broadcasters' studios and require expensive human and technical support systems. Basically, the quad is a 4-head video recording system that produces pictures on the tape by scanning the videotape at a 90° angle as it travels by at high speed—15 IPS (inches per second). One roll of 1-hour quad tape costs $250-$300. The quad is an expensive animal to feed.

The other type of video recording process is known as HELICAL SCAN RECORDING. Invented by Toshiba Corporation of Japan in 1953, helical scan utilizes a screw-like scanning process that places the video information DIAGONALLY along the tape. The helical scan mechanism uses only 1 or 2 heads, is much simpler than the quad process, and moves the tape along much slower—from 9 to 1½ ips. This slower rate of tape travel and the use of smaller tape greatly reduces tape consumption and operational and maintenance costs of helical scan recording relative to quad recording.

Tape size or width determines the TAPE FORMAT. A particular VTR is designed for one particular tape format only. At present, there are 5 different tape formats—2-inch, 1-inch, ¾-inch, ½-inch and ¼-inch. A ¾-inch wide videotape can only be used with a VTR specifically designed to use ¾-inch tape. Thus the VTR becomes known as a *¾-inch VTR* or a *¾-inch format VTR.*

None of the different tape formats are compatible with any other format and in some cases, there is no compatibility even within the *same* format. For example, Sony has manufactured three different yet incompatible 1-inch VTR formats. It sounds crazy, but don't despair.

Although you can't take a ½-inch tape which was recorded on a ½-inch VTR and play it back on a 1-inch VTR, it's quite possible electronically to TRANSFER or COPY the tape to any other size VTR format. In this case, you are making a SECOND GENERATION copy of the tape which will probably suffer a slight quality loss but still be quite acceptable. So, even though VTRs may not be *physically* compatible, they are all *electronically* compatible, especially with the help of a time base corrector.



Quad Scanning Process

Helical Scanning Process

VTR USE TABLE

TAPE FORMAT Size	SCAN TYPE	MODE	WHERE USED	HOW USED	WHY USED	COST RANGE	PORTABILITY

A Comparison of Film and Audio Recording

There are 2 common methods of recording picture and sound—*chemically*, as in film recording, and *electronically*, as in video recording. In the first process, the film image undergoes a chemical change in reaction to light. In the second instance, the video image and audio elements undergo an electronic conversion from light and sound to voltage and magnetism.

Since video and audio are both electronic media, they bear a closer relationship to each other than video does to film. It is important to realize that the video recording process evolved from the audio recording process rather than from the film recording process.

THE VTR RECORDING PROCESS

Recording Heads

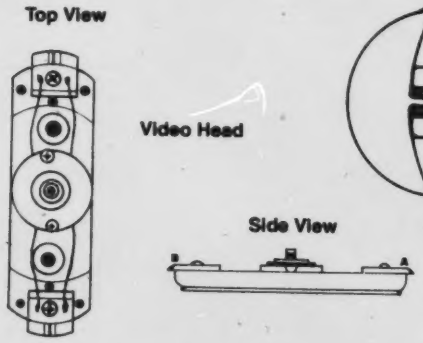
Like an audio recorder, a recording VTR uses a series of magnetic RECORDING, ERASE and PLAYBACK HEADS. These heads contain electromagnetic coils which when energized, create a magnetic field in the coil. This in turn causes the magnetic particles on the videotape to respond and store the electronic information.

The VTR is unique because it employs special rotating VIDEO HEADS which record and play back the picture component of the electronic information. The video heads are made up of tiny magnetic coils with a small gap between them.

Unlike stationary audio heads, video heads will not work if they are standing still. Instead, video heads must rotate at a high speed, in the *opposite* direction to the tape travel. This rotation is apparent when the VTR is placed in PLAY or RECORD mode and a pronounced whirring sound is heard emanating from the video head drum.

Inside the Video Head Drum

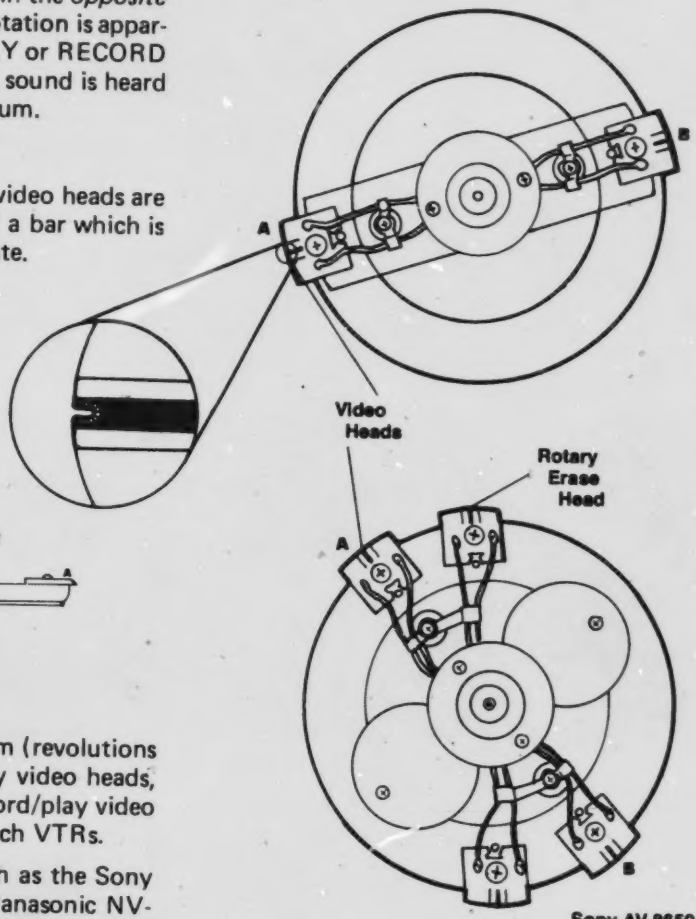
On all ½-inch EIAJ VTRs, two video heads are used, one located on each end of a bar which is mounted on a circular rotating plate.



The head bar rotates at 1800 rpm (revolutions per minute) if it has 2 record/play video heads, and 3600 rpm if it has only one record/play video head—as is the case with many 1-inch VTRs.

Sophisticated editing VTRs such as the Sony AV-8650 and VO-2850 and the Panasonic NV-3160 employ 4 rotating video heads—2 heads to record and to play back the picture, and 2 additional erase heads mounted just ahead of the record/play heads to insure that erasing of the old picture information is complete right up to the point of the new recording. The stationary erase head is still used, but the distance between the rotating video heads and the stationary erase head can prevent precise editing of the new picture. Therefore, ROTARY ERASE HEADS are used to insure perfect erasure of old picture information right up to the point of the new edit. In ¾-inch videocassette recorders, the video heads are integrated into the rotating head drum itself. This system is simpler and has fewer problems. Some new generation 1-inch VTRs (Ampex and Sony) also use 1 or 2 additional heads, as well as the flying erase and record/playback heads for improved tracking, broadcast quality slow-motion and for monitoring playback *during* recording.

EIAJ Video Head Assembly



Sony AV-8650 With Rotary Erase Heads

The Rotating Video Head

Video heads must rotate at high rates of speed because of the necessity to record and reproduce the very wide range of frequencies required by the video picture. Even the most sophisticated of stationary recording heads used in high quality audiotape recorders can record and play back only 20 to 20,000 Hz. HERTZ (Hz) is the official designation for cycles per second. Video, however, requires a range of 2.5 MHz (million, or MEGA-HERTZ) for black-and-white, and 3.5 to 4.5 MHz for color—or 18 octaves! Frequency response is traditionally extended in several ways:

1. improve the electronics and the tape
2. increase the size of the tape
3. increase the speed of the tape past the head

Early attempts to record video information on tape involved the use of 2-inch wide tape traveling 50 to 100 inches-per-second (ips) past stationary video heads. Obviously the economics of this approach was not encouraging, as the VTR was huge and the tape costs were astronomical.

Then some creative thinking produced the idea of moving the video head at high rates of speed counter to the tape direction, thus creating a very high relative TAPE-TO-HEAD or WRITING SPEED. The writing speed for quad is 1000 to 1500 ips at a TAPE SPEED of 15 ips, and about 700 ips is the writing speed for U-Matic at a tape speed of 3-¾ ips. Low-cost VTRs now could become a reality.

NOTE: Since the video heads do rotate at high speed and actually contact the moving videotape, *use only good quality proper video tape and keep the video heads clean.* The video heads usually are made out of FERRITE, a material which has excellent frequency response but is brittle and will damage easily. Therefore, *no hard articles should be placed on or near the video heads,* especially if they are still rotating.

Replacement of video heads for ½-inch or ¾-inch VTRs will cost approximately $150, including labor. With proper care, cleaning and use of good tape, video heads should last for 2 or 3 years of frequent use. Sony claims 1000 hours life expectancy for its video heads.

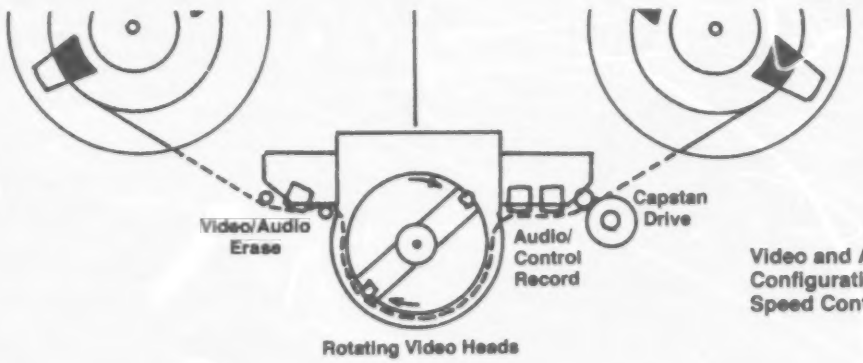
Tape Speed/Size Cost Comparison

Tape Size	Format	Tape Speed	60 Min. of Tape	Cost
2 inch	Quad	15 ips	4800 ft	$300
½ inch	EIAJ	7 ips	2400 ft	35
¾ inch	U-Matic	3¾ ips	1200 ft	30
½ inch	Betamax	1.5 ips	480 ft	15
½ inch	Beta-2 hr	0.785 ips	240 ft	7

VTR Mechanics

1. Speed Control—Every VTR must have a multiple configuration of erase, record and playback heads. The VTR also must have a very precise speed control system because proper VTR speed is critical to picture stability and quality.

2. SYNC—Besides the picture and sound, there is a third consideration when recording a videotape, the synchronization or SYNC PULSES that must accompany the picture component. These sync pulses are horizontal and vertical pulses or signals usually generated from the video camera and always accompany the video picture. The sync pulses permit the scanning system to reconstruct the video picture on the TV monitor. These pulses are ENCODED or combined with the video picture during recording and playback. The combination of sync and picture elements (video) is called a COMPOSITE VIDEO SIGNAL.



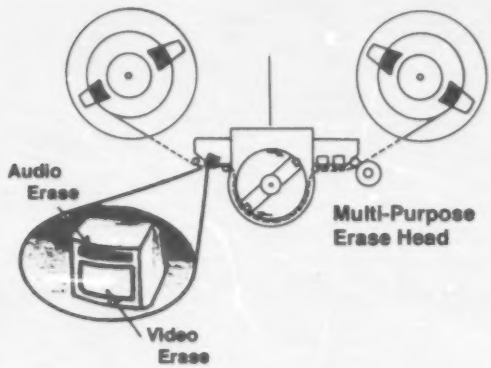
Video and Audio Head Configuration and Speed Control

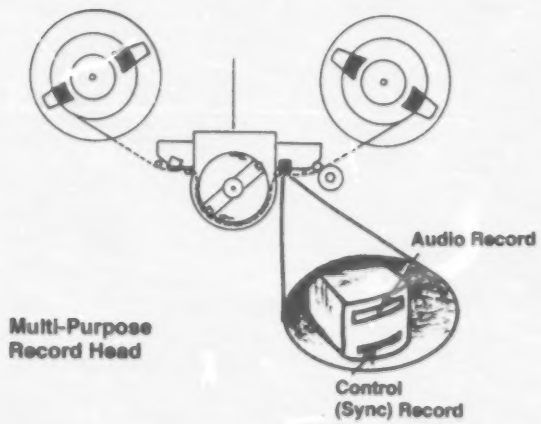
3. Control Track—The VTR also records special CONTROL TRACK PULSES on the tape through a CONTROL TRACK HEAD, usually a separate track on the audio record or erase head. The control track pulses help the VTR maintain proper speed, which is critical to accurate playback of sync pulses.

The control track pulses on the videotape are often referred to as "electronic sprocket holes," to draw a film recording parallel. These pulses are regularly spaced along the videotape and will greatly affect the quality of the playback picture if the control-track head becomes clogged or malfunctions. The movement of the tape through the VTR is mechanically controlled by the CAPSTAN DRIVE.

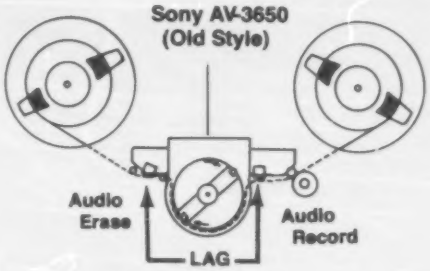
Multi-Purpose Heads

Often a single head will combine 2 different functions. All Sony ½-inch VTRs except the AV-8650 perform both audio and video erase on one stationary head and audio record and control-track record/playback on a second head. This allows editing of the sound without affecting the video. All recording VTRs can do this.

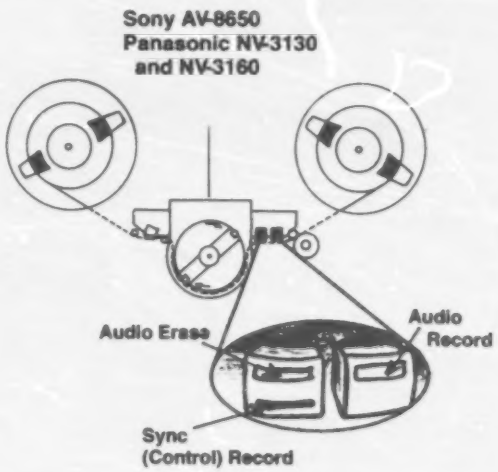




Unfortunately, because of the distance between the audio erase head and the audio record head, there is an annoying audio lag when editing on machines like the Sony AV-3650. Panasonic VTRs and the Sony AV-8650 place a third stationary head that performs audio erase right next to the audio record head. The audio lag is then eliminated.

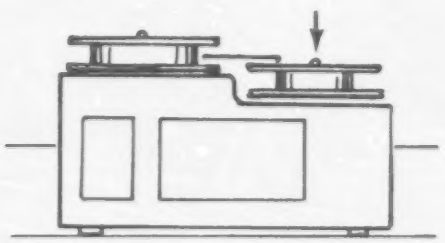


Dual Head System



Helical Diagonal Tape Scanning

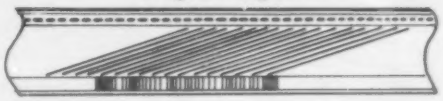
A distinguishing characteristic and one of the more curious aspects of helical scan VTRs is the different levels at which the tape reels are placed. One side is always considerably higher than the other side.



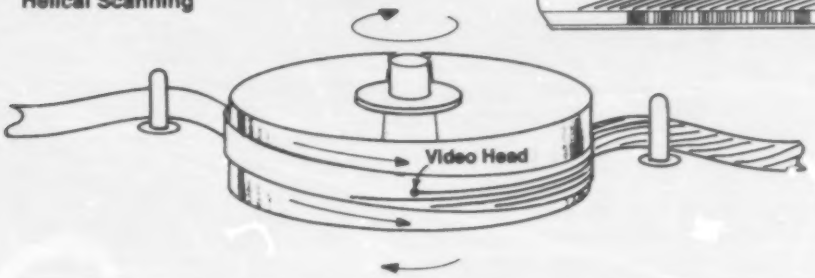
On most EIAJ ½-inch VTRs, the left SUPPLY-REEL side is always about 1 inch higher than the right TAKE-UP-REEL side. Because of this height difference, the tape will travel through the VTR on an angle. The rotating video heads are mounted in a flat plane thereby contacting the tape in a screw-like (helix) diagonal fashion and creating more surface contact.

Each of the diagonal lines scanned across the tape by the rotating video heads represents a specific amount of picture information. The method of laying down the video tracks on the tape is determined by the way the video or TV scanning system process works.

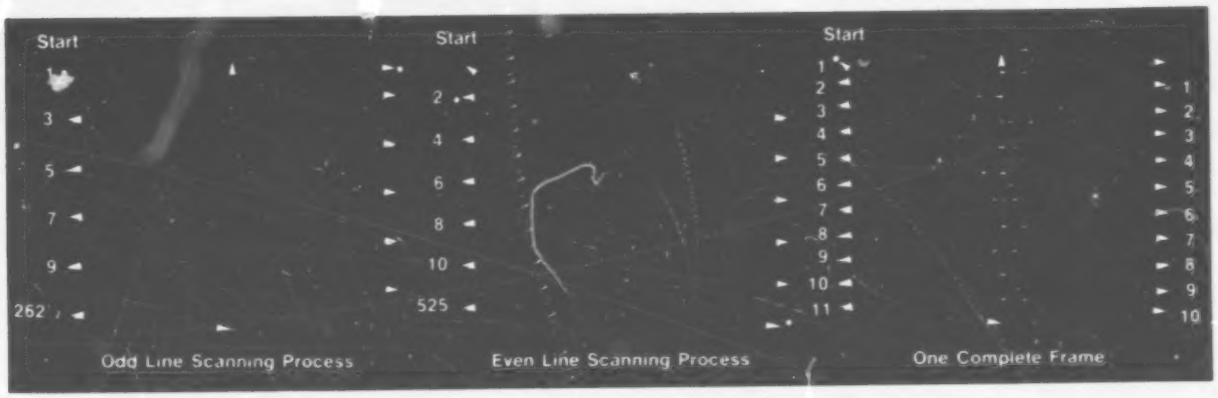
Diagonal Signal



Helical Scanning



The TV Scanning Process



First Field 1/60th Sec + **Second Field 1/60th Sec** = **Complete Frame 1/30th Sec**

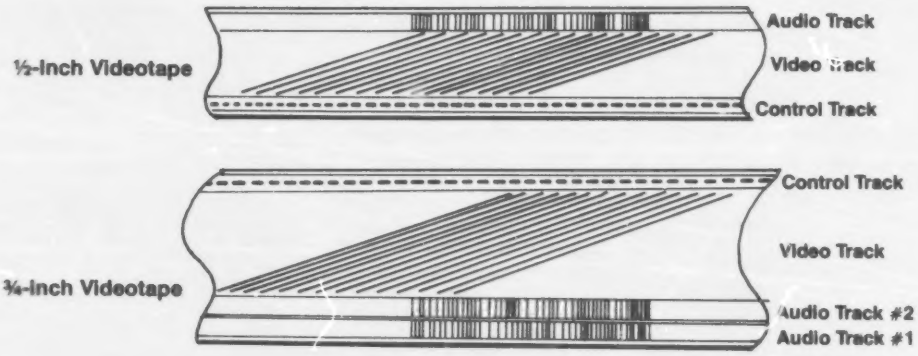
Unlike film, the video image is made up of 525 horizontal lines. The scanning electron beam in the camera tube and in the CRT (TV tube) scans every other line, or half the total number of lines (262½) in 1/60th of a second, odd lines first. Then, the beam goes back and scans all the even lines in the same amount of time (1/60th of a second). Each set of 262½ lines is called one FIELD, and the two fields are INTERLACED to make one 525-line FRAME. 30 complete frames are scanned each second—a rate fast enough to give the eye a sense of continuous motion. 16 mm film operates at only 24 frames per second, so the difference in FRAME RATES causes a black line to appear in the picture when you are filming a TV set in operation.

If a VTR uses a SEGMENTED recording system, it will have 2 video heads—one head per field of information. If it is NON-SEGMENTED, it will have only 1 head which must record and play back both fields. In a 2-head VTR, every time a video head scans the tape, one field of information is recorded or recovered from the videotape. When you look at a single "frame" of tape, all you really see is one field. This is why the quality of a still frame is never as good as the moving tape image, because then you are seeing fields interlaced together as complete frames.

During the scanning process, horizontal and vertical sync pulses are generated to tell the electron beam to scan the picture correctly both horizontally and vertically. These pulses keep the picture straight from top-to-bottom and from side to side. The combination of sync pulses and video information (composite video) is then placed on the videotape by the two rotating video heads.

The video heads in a 2 head VTR will make 1800 revolutions per minute or one pass with each head every 60th of a second. As previously stated, since the tape travels past the heads on a diagonal, each field of information is placed on the tape diagonally, thus permitting more information to be stored by the tape. The video portion of the tape requires approximately 85%, and the audio and control tracks take up much of the remaining 15% so the tape cannot be reversed to record on the other side as audiotape can.

TRACKS ON TAPE



The Audio Track

The AUDIO TRACK is usually located on the top part of the tape. Because it is on the same tape as the picture, the sound always will be in perfect sync with the picture at all times. Unfortunately, ½-inch and ¼-inch videotape has only enough room to allow one audio track. Larger formats fit 2 or more audio tracks on the tape, permitting added editing flexibility and the capability to record stereo sound. New-generation 1-inch and broadcast ¾-inch and 2-inch VTRs have a third audio (or CUE TRACK) for recording special TIME-CODE information, used in editing for reference to individual frames on the tape.

The Control Track

The control track contains the control track pulses which regulate the speed of the VTR and the rate at which the tape is moved through the VTR. Very precise speed control is necessary for proper reproduction of the original recording. First, the rotating video heads must align perfectly with the video tracks on the tape. The heads also must simultaneously utilize the corresponding control-track pulses which will insure the correct picture playback.

Alignment of the video heads with the tape tracks is called TRACKING. This is the source of many VTR play-back problems. If the tape guides are misadjusted, the head-drum sticky or dirty, control-track head out of alignment or the speed of the VTR is not precise, the tape will not play back very well.

The TRACKING CONTROL on VTRs is designed to compensate for some differences in video head alignment relative to the video tracks. If you have problems of this nature, have your VTR checked with a manufacturer's special ALIGNMENT TAPE.

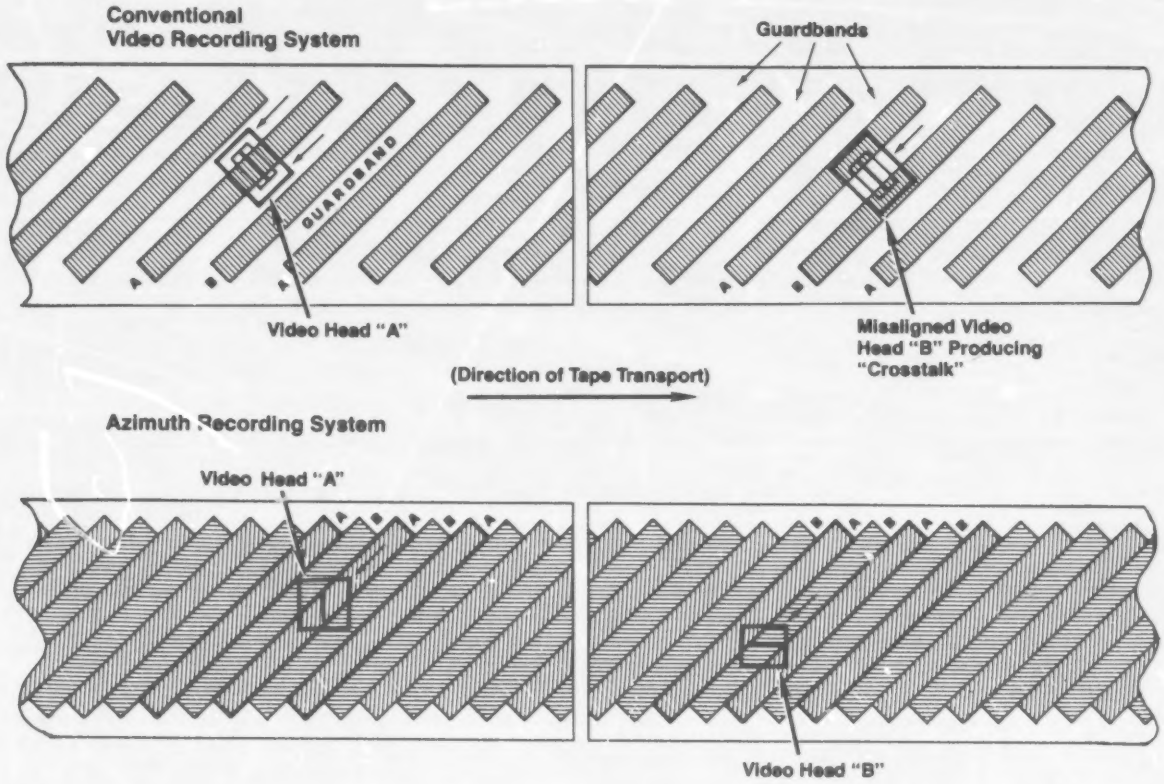
Stretching of the tape will distort both the timing of the control track pulses and the reading of the video information. FLAGGING, or bending problems then will result at the top of the picture during playback. The SKEW or tape tension control on the VTR can be used to minimize this situation somewhat. Extreme problems will require that the tape be processed by a time base corrector.

SOME INTERESTING STATE-OF-THE-ART VTR RECORDING SYSTEMS

The Azimuth Recording System

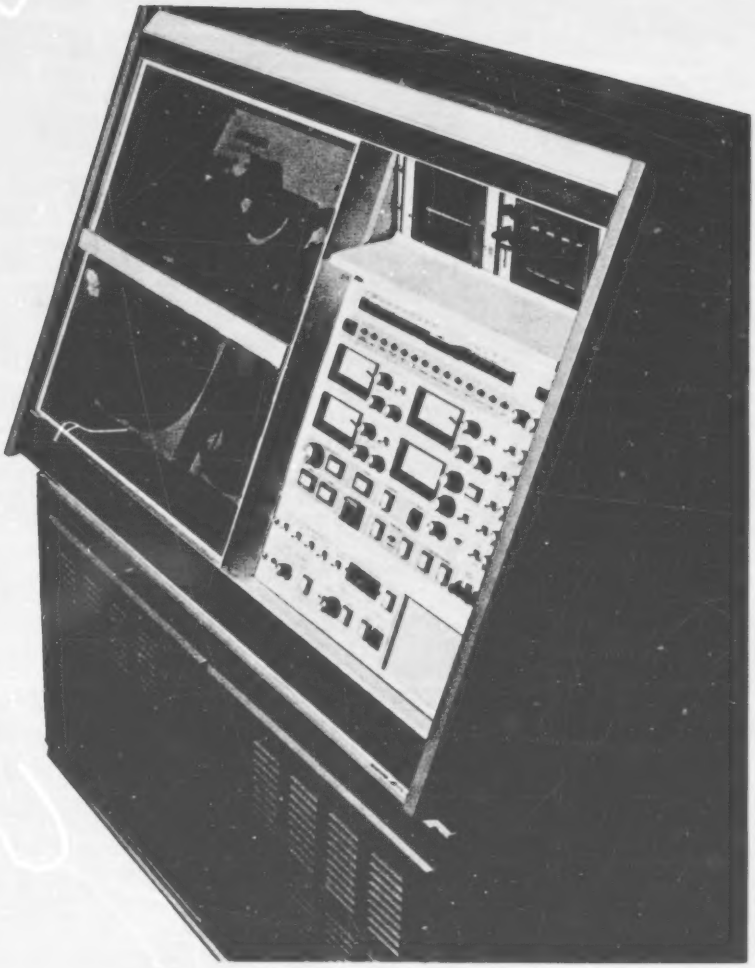
Normally, the diagonal tracks that the video heads scan across the tape must have small separations (GUARDBANDS) between them, so a slightly misaligned video head does not accidently pick up the information from an adjacent track. The undesirable interference of a signal from an adjacent track is called CROSSTALK.

Since these separations between the tracks wasted valuable recording space, Sony engineers set out to remedy the situation. They ingeniously devised a way to utilize the empty spaces between the tracks by slightly offsetting or angleing the video heads at 7^{o} to each other. Thus the heads could record an individual track that could be sensed only by that same head because of its angle or AZIMUTH. In this manner, head "A" can pick up only information on track "A," and head "B" can sense only information on track "B," even if the heads become misaligned. If the heads pass over the wrong tracks, no signal will be produced because the head will be out of phase with the track's information.



Elimination of guardbands allows more information to be stored on a narrower tape width. The Azimuth Recording System was designed specifically for use with the Betamax and Beta 2-hour VTR formats and represents another significant step forward in VTR evolution.

The Azimuth Recording System, as used on the Betamax, does reproduce surprisingly good color video for a VTR that moves the tape past the heads at such a slow speed. This seems to be the direction in which VTR designs are moving—slower tape speeds for economy, but with improved picture quality. Achieving both these goals simultaneously is like creating a bigger and faster automobile that also gets more miles per gallon. But the Japanese always have been able to create seemingly impossible technology!



The IVC-9000 Recording System

International Video Corporation (IVC), an innovative American video company noted for its excellent line of 1-inch VTRs, has conceived and developed a 2-inch *helical scan* broadcast TV master-production VTR that exceeds the quality performance of a quad VTR, yet uses only one half the amount of tape.

The IVC-9000 VTR uses 2 rotating video heads (segmented scan) which strike the tape at a diagonal angle of 19.55°. This reduces the head-to-tape impact by 18:1, compared with a quad head which must strike the tape at a 90° angle. The picture quality and performance of the IVC-9000 is truly incredible and the machine itself really looks spacey.

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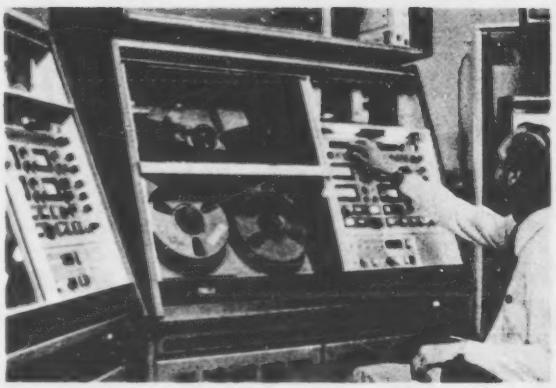
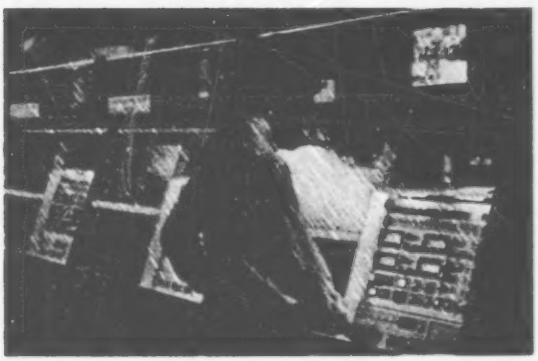
General Features of the IVC-9000:

- Uses HOT PRESSED FERRITE (HPF) video heads which have better frequency response than the metal heads of quad VTRs.
- Performs well on all 3 TV standards—NTSC, PAL and SECAM
- Has a wide variety of tracks
- All tracks can be edited simultaneously in any combination, or individually.
- The control track is located in the stationary section of the head drum, so the 300-Hz control track pulse is recorded directly beneath the corresponding video track—not later at some distance from the SCANNER (the video head drum) where differences in tape tension can affect tracking.
- Fast, accurate tape handling. Precision mechanics and controls provide tape movement speeds continuously variable from 2 to 300 ips in forward or reverse. This permits rapid and efficient search for locations of specific edit points on the tape.
- The tape transport and scanning mechanism are completely enclosed in a positive pressure environment fed by filtered air. Vacuum columns constantly clean the tape by drawing air across it and removing loose debris and dust particles.





Tape Economics—Because the IVC-9000 uses helical scan 2-inch videotape, the cost is less per foot than quadruplex videotape. The higher efficiency of the HPF heads permits scanning of a greater number of video tracks per square inch than in the quad method. The IVC-9000 has a tape speed of 8 ips and can record the same amount of information on slightly more than one-half the amount of tape used by a 15 ips quad VTR. A minimum of 2 hours of program material can be recorded on a 10½-inch reel of videotape. Lower tape cost, less tape-per-unit time, and less tape storage space adds up to an economic advantage for the IVC-9000. Of course, it is a beautiful piece of engineering and a high-priced machine intended for use by broadcast TV stations. Videotapes made on this machine can be played back only on another IVC-9000.

Plug-in modules (Models IVC-9000-4 and IVC-9000W) are available for the basic IVC-9000. They can convert it to 4 hour recording capacity or SUPER-HIGHBAND 8 MHz frequency-response (IVC-9000W). The IVC-9000W can be used for tape-to-film transfers where very high resolution (700 lines b&w, 500 lines color) is necessary. The conversion module IVC-9000M will allow the 8MHz version to operate at a 655-line 48-field rate which enables it to interface with the film industry's standard 24 frames-per-second rate. This version should improve the tape-to-film transfer system significantly.

COLOR VTRs

The Heterodyne Color Process

It isn't really too difficult for a black-and-white VTR to record color. Only a few extra steps and circuits are needed. But the design of small-format VTRs—½-inch, ¾-inch and ¼-inch does not make it possible to process directly the very high (3.58 MHz) COLOR SUBCARRIER required by the color picture. A method therefore was devised to reduce the color frequency to only 267 KHz (KILOHERZ is thousand cycles) which the small-format VTRs could record easily. This process of reduction is called HETERODYNING and nearly all Japanese color VTRs use the HETERODYNE COLOR PROCESS if they fall into the class of LOW-BAND VTRs. LOW BAND means they can record only a small, limited bandwidth (about 2.5 MHz) or frequency response.

The Heterodyne color process also requires separation of the chrominance and luminance elements of the picture. Upon playback, the 767 KHz signal again is boosted to 3.58 MHz. Because the phase of the color in the 767 KHz subcarrier is not locked to the horizontal frequency of the video signal, heterodyne color *does not meet FCC* broadcast standards and *cannot* be played directly over the air.

The Direct Color Process

So called HIGH-BAND 1-inch or 2-inch VTRs are capable of much better frequency response characteristics and are able to record easily the 3.58 MHz signal directly. These VTRs are called DIRECT-COLOR VTRs. All 2-inch quad VTRs are high band VTRs and can record and play direct color only. If you are transferring a tape from ½-inch or ¾-inch VTR to quad, the heterodyne color must be converted to direct color. This usually is done by placing the appropriate time base corrector (TBC) between the small-format heterodyne VTR and the direct color quad VTR. Most TBCs can change the heterodyne color of the small-format VTR to direct color for direct over-the-air broadcasting or transfer to a 2-inch quad for copying or editing.

The Range of VTRs

The range of VTR technology is mind-boggling. Simple playback-only ½-inch units can be bought for $800 or less. Or, for a totally computerized quad VTR with vacuum tape-drive chambers, fantastically high-quality color and super-precise editing ability, you could spend over $250,000.

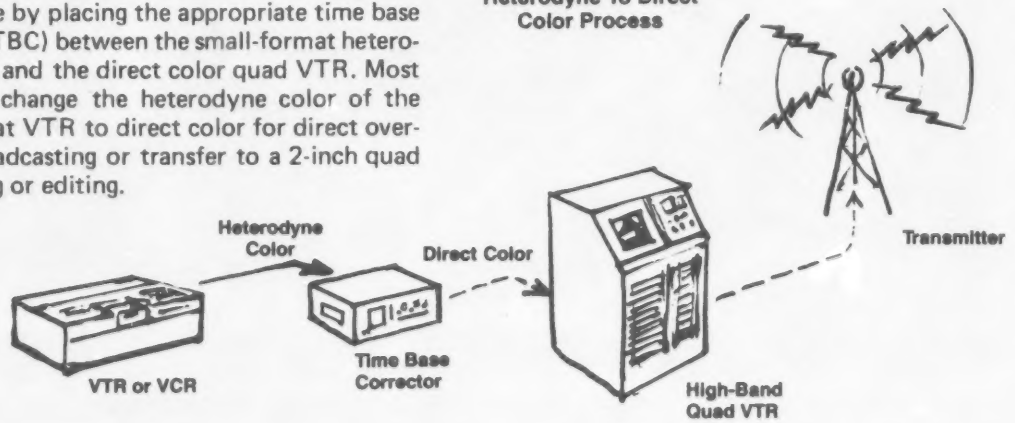
VTR technology has evolved rapidly, especially with the introduction of integrated circuits and space technology. In its wake, it has left lots of obsolete 1-inch and ½-inch VTRs, which are still quite adequate for simple b&w applications. These units can be purchased inexpensively and if they work okay, can be fine machines on which to learn.

So, why not provide a home for a 1-inch Ampex or Sony VTR that is sitting lonely and forgotten on a basement shelf just gathering dust?

Happily, technical advances have definitely reduced the price of good-quality color recording, playback and editing VTRs. A wide range of ¾-inch and ½-inch color machines, (some very sophisticated) is available to fill nearly every video user's needs. As with cameras, you should shop around for a demonstration of a particular VTR's recording, playback and editing qualities and talk with owners of similar equipment. Make edits and copy the tape several times to see how well the color quality holds up. This will give you a good indication of the quality of the VTR.

With some understanding of VTRs, we now move on to the recording medium itself—The Videotape.

Heterodyne To Direct Color Process



Chapter 6
All About Videotape

Introduction

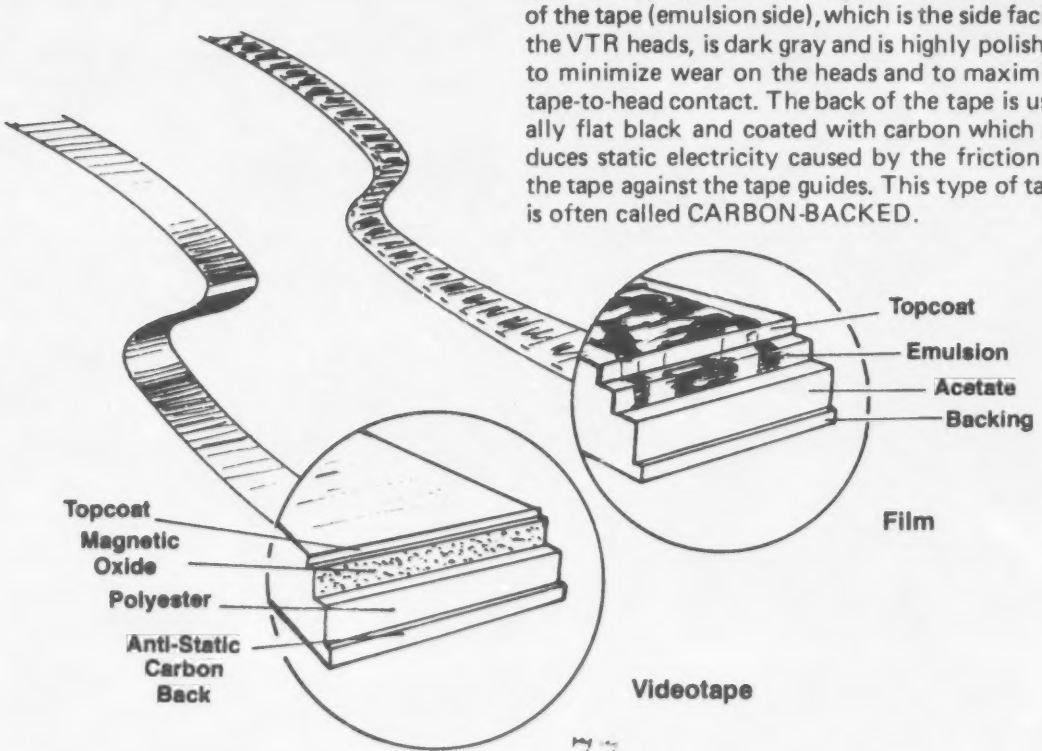
No video recording is possible without videotape. The technical quality of a finished production depends greatly on the quality of the videotape used. Old, worn or poor quality videotape can produce a distorted picture or can even clog the video heads, resulting in no recording at all.

It is most important to understand how the videotape functions in the video recording process. As was mentioned in *Chapter 5*, a recording head produces a magnetic field which stimulates the magnetically-sensitive material on the videotape in such a way as to record and store picture and sound information which can be played back later.

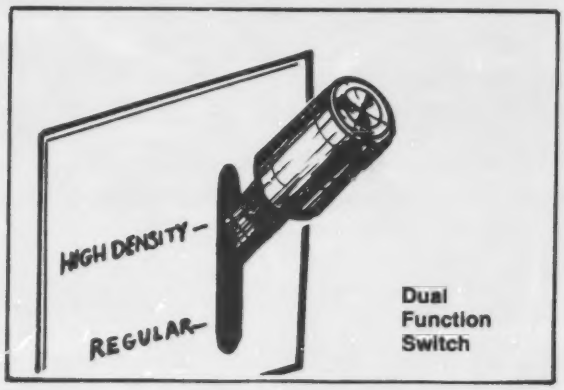
Comparison with Film Recording

Film consists of various layers of chemicals on an acetate base. In contrast, videotape is a layered configuration whose surface has a magnetic coating of needle-shaped iron-oxide or chromium-dioxide particles which lie in a length-wise direction on the tape (helical scan only). A binder material holds these particles in place and makes them adhere to the polyester base. The magnetic material determines the tape's magnetic properties such as frequency response, sensitivity and SIGNAL-TO-NOISE RATIO.

Signal-to-noise ratio measures the amount of pure picture or sound signal as compared to the amount of grain or "noise" (interference) in the picture. The higher the ratio as rated in DECIBELS (db), the cleaner the picture. The surface of the tape (emulsion side), which is the side facing the VTR heads, is dark gray and is highly polished to minimize wear on the heads and to maximize tape-to-head contact. The back of the tape is usually flat black and coated with carbon which reduces static electricity caused by the friction of the tape against the tape guides. This type of tape is often called CARBON-BACKED.



There are several kinds of tape on the market. The most common is the IRON OXIDE type tape, in use for many years and now improved considerably. Newer type tapes such as CHROMIUM DIOXIDE and COBALT-DOPED type produce greater frequency response and have a longer life than the older iron oxide type. Eventually, magnetic tape itself will be superseded by a solid-state random access memory system that will take the form of a small magnetic card, cube or cylinder.



Dual Function Switch

High-Energy or High-Density Tape

All ¾-inch, Betamax, Beta-2 and other new ½-inch formats utilize only HIGH-DENSITY tape. This tape requires a higher erase and recording current than standard iron-oxide tape and should not be used for recording on VTRs that are not designed for high-density tape. Certain ½-inch EIAJ color editors, specifically the Sony AV-8560 and the Panasonic NV-3160, have a dual-function switch that allows them to use *both* standard ½-inch tape and high-density tape (Sony V-72). High-density tape should always be used when possible, especially in editing as the picture quality and image sharpness is considerably superior (about 3 db) to standard tape.

The ability of the tape store information is expressed in density of particles or OERSTEDS OF COERCIVITY. Standard ½-inch EIAJ reel-to reel tape (Sony V-32 or V-30H) is rated at 300 oersteds, whereas the Sony V-72 ½-inch cobalt-doped high-density tape is rated at 530 oersteads, and Betamax tape is rated at 750 oersteds.

Videotape Characteristics

Unlike film, any piece of videotape will record *both black-and-white and color* signals. However, color is *NOT* a function of the videotape, rather it depends on whether or not the camera, VTR or TV monitor is black-and-white or color.

Videotape determines picture quality. No matter how sophisticated the video hardware, the resulting picture quality is only as good as the videotape used. Manufacturing videotape properly requires expensive equipment and extremely strict quality control. Unfortunately, videotape tends to be expensive because the process of manufacturing is complex and critical and requires costly petroleum as a major raw ingredient. An hour of ¾-inch videotape retails for $25-$35 with slightly lower costs for 30 and 20 minute tapes.

There are many brands of videotape on the market, some very inexpensive, which are usually used tape from TV studios—2-inches wide that is cut up into ½-inch tapes. Often this tape clogs the VTR and leads to expensive breakdowns and video head replacement. Unless you test it first, you can't tell how bad the tape really is until after you have recorded some very important programs on it. Then it begins to break down and loose particles will clog the machine. Use of computer or instrumentation tapes also involves a definite risk to the VTR and program material. Most people who use these brand "X" videotapes regret it sooner or later.

The best rule to follow is to use only tape recommended by the VTR manufacturer. If this is impractical, Sony tape is the helical scan standard for videotape by which all other brands are measured. Sony tape will work well on nearly any helical scan VTR. Other brands are MEMOREX and 3M. Even Sony manufactures bad batches of tape occasionally. If this happens, tape can be returned to the distributor and exchanged.

Extended-Play Tapes

Certain manufacturers offer EXTENDED PLAY TAPES. Dupont has a 90-minute ¾-inch standard size videocassette and a 30-minute KCS type (smaller size ¾-inch) videocassette. Panasonic has a 90-minute ½-inch EIAJ reel-to-reel tape and 3M manufacturers the 30-minute extended play tape for use with the Panasonic and Hitachi ½-inch EIAJ cartridge VTRs. The only way to gain the additional recording and playback time is to make the tape thinner—a factor which can increase the chances of the tape breaking, developing more dropouts, deteriorating faster and jamming the cartridge or cassette VTR.

CAUTION: Use of thinner tapes is not recommended for heavy use situations, such as mastering, still framing, editing or mass duplication of important programs intended for large scale distribution.

Comparative Tape Thicknesses

[illegible] standard length	26 microns or 1.00 MILs
[illegible] extended play	17 microns or .70 MILs
[illegible] standard length	28 microns or 1.14 MILs
[illegible] 30 minute cassette	13 microns or .50 MILs
Betamax standard length	20 microns or .79 MILs
Sony V Cord II	19 microns or .75 MILs

How Videotape Works

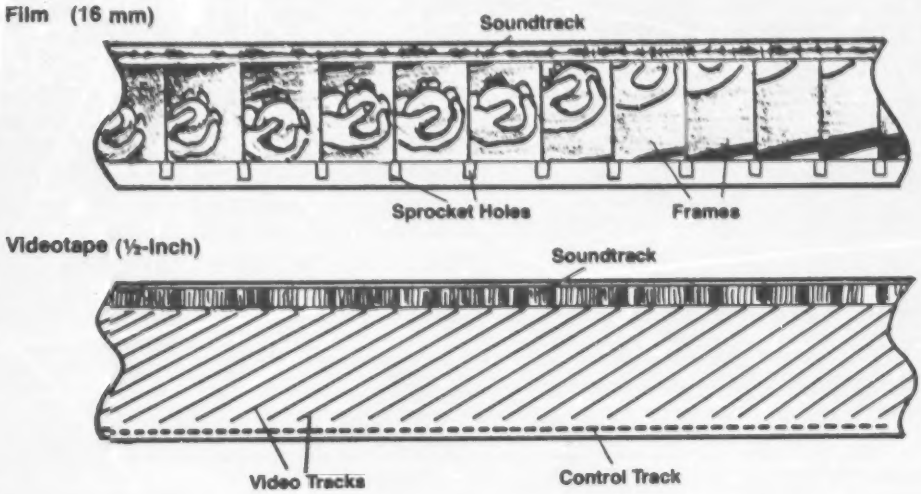
Like film, videotape is the image storage medium. But unlike most film, videotape contains the capacity to store *both* picture and sound. Both film and videotape record individual pictures or frames of information. 16 mm motion picture film records 24 individual frames every second while video records 30 frames a second.

These frames are visible on the film along with the sprocket holes which control the rate at which the images are run through the camera or projector. The sound track is placed next to the picture images and synchronized to match them. Sound-to-film sync often requires additional equipment and added extra steps.

A nice feature of movie film is that you actually can see the individual pictures. With videotape, the frames are not visible to the eye, but they are present in a series of diagonal lines formed by the magnetic particles on the tape.

Videotape Dropouts

Videotape DROPOUTS occur when a piece of the tape's magnetic oxide or coating flakes off or is rough. This causes a "hole" or missing line of information in the picture when viewed on the monitor during tape playback. Since dropouts are a function of the tape and not the VTR, they are visible only when the tape is played back.



These "holes" or missing lines of information are created when the video heads fail to contact the tape firmly and skip over it because of roughness, hills and valleys or actual missing flaked-off pieces of the oxide. When the tape particles flake off, the tape can never contain or store information at that point. Once a dropout occurs, it can't be corrected physically. Nearly all newer VTRs, especially the color models, feature electronic DROPOUT COMPENSATORS (DOC) or ONE-LINE DELAY circuits which electronically substitute or repeat the previous intact line of video information, thus electronically "covering up" the dropout. The circuitry senses the dropout while it occurs and replaces it with a good line of information, thus eliminating the appearance of the dropout on the monitor.

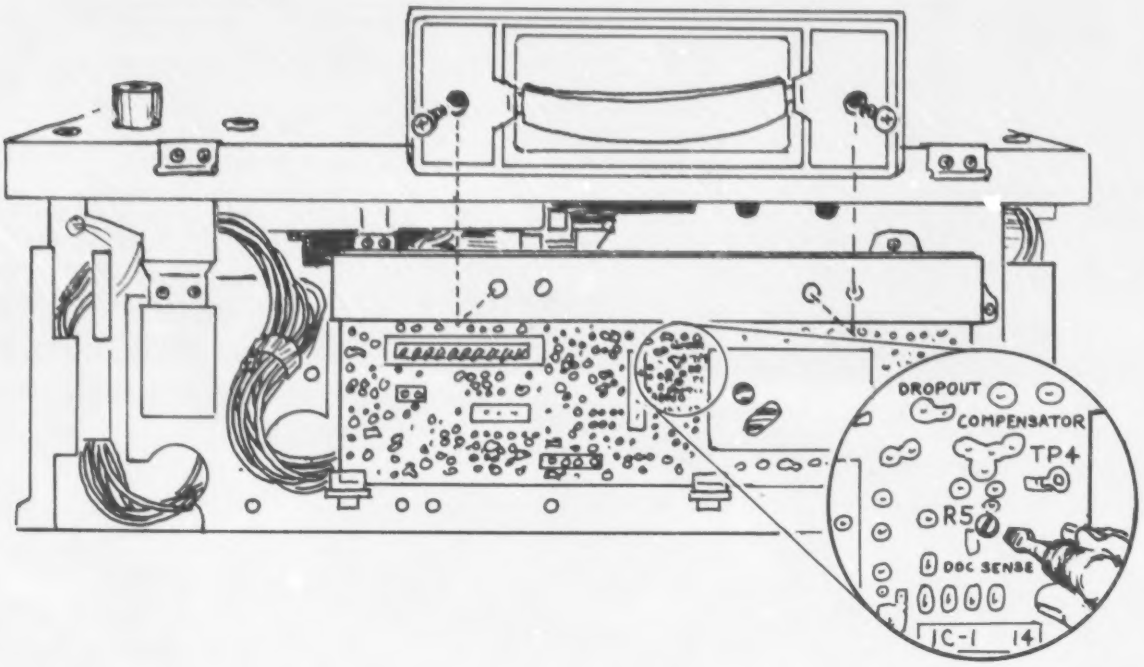
Dropouts are bad enough in black-and-white but can become intolerable in color because the dropout is so much more apparent in color. For this reason, all color VTRs (except some early model Sony AV-8600s) contain one-line delay systems. Occasionally, dropouts will exceed the ability of the one-line delay system to compensate, and some dropouts will sneak through.

Dropouts

One-Line Delay System Adjustment

The one-line-delay system may need adjustment when it fails to cover up dropouts adequately. On the Sony AV-8650 a marked control becomes accessible by removing the VTR from its case. While watching the tape playback on the monitor, you can play the tape with the dropouts and adjust this control for maximum compensation.

One Line Delay System Adjustment

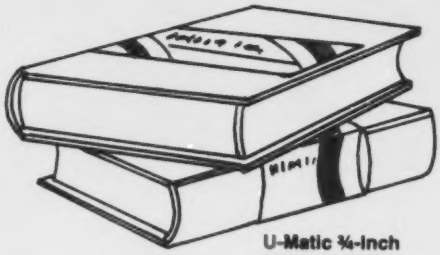


Dropouts often occur at the beginning and the end of a reel of tape, and because of this, you should never record important scenes on these portions of the reel. Tape will accumulate dropouts with use, age and abuse. Sony videotape specifications indicate that up to 25 dropouts-per-minute can be expected throughout a reel of ½-inch tape. If the dropouts really become constant and annoying the tape should be discarded or used for expendable programs. Loss of sync and picture instability can occur when you have 2 or 3 dropouts per second.

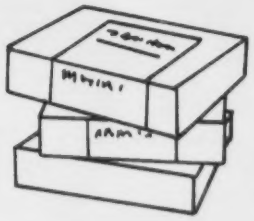
Videocassette Tape

The appeal of videotape recorders to home users and nontechnical persons always has been limited by the hassles of threading and handling reels of videotape. Far greater use of the audio medium immediately followed the introduction of audiocassettes and cartridges and the design of self-threading self-contained audio systems. The same has been true with video systems. The videocassette system has made it possible for many more people to deal confidently with videotape and videotape recorders.

Although videocassette tapes have many positive features, they also have certain drawbacks. These features and problems are dealt with specifically in *CHAPTER 11—All About Basic Videocassette Systems*. In the meantime, we will proceed to examine how everything gets plugged together, and how you can make the right connections.



U-Matic ¾-inch Videocassettes



Betamax ½-inch Videocassettes

CARE OF VIDEOTAPE

- Do not smoke in or near or within several rooms of VTR equipment. Check air flows through building.
- Keep VTRs covered at all times when not in use to minimize dust accumulation.
- Keep VTRs as clean as possible.
- Use same size reels for supply and take up.
- Minimize hand contact with recording part of tape.
- Do not wrinkle or bend tape.
- Do not expose tape to dust, moisture, heat or extreme cold.
- Avoid high humidity.
- Always keep tape sealed in package when not in use.
- Never stack tapes on top of each other—store tapes vertically at room temperature.
- Cut off any wrinkles and severely damaged tape ends.

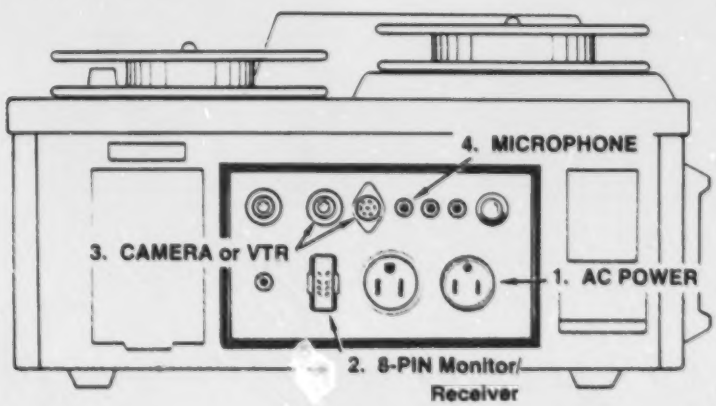
Chapter 7
Making The Right Connections
Plugs and Wires

Making Ends Meet

Plugs and wires, cables and connectors are an essential part of every video system. This chapter will help you understand why there are so many different kinds and what each one is supposed to do. We will progress from the simplest cable connections to the more complex wiring schematics. Feel free to use whatever information your needs dictate.

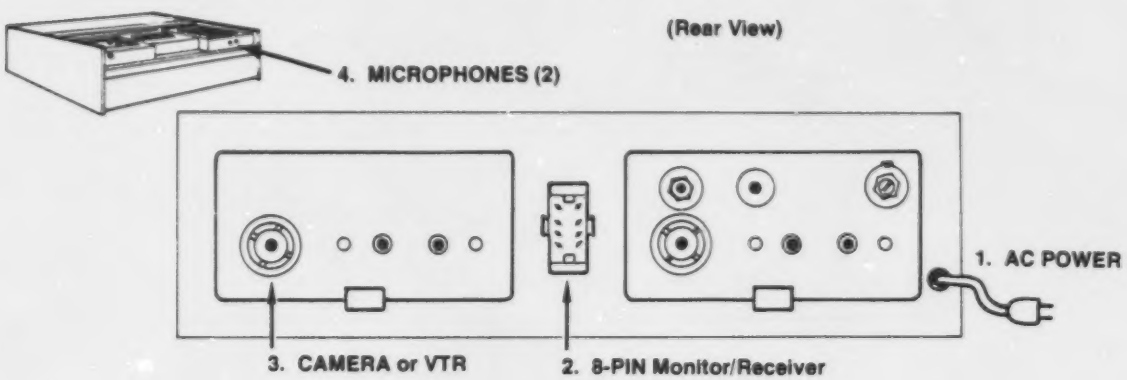
PRIMARY CONNECTIONS—STUDIO VTRs

½-inch EIAJ reel-to-reel VTR



(Rear View)

¾-inch U-Matic VCR



(Rear View)

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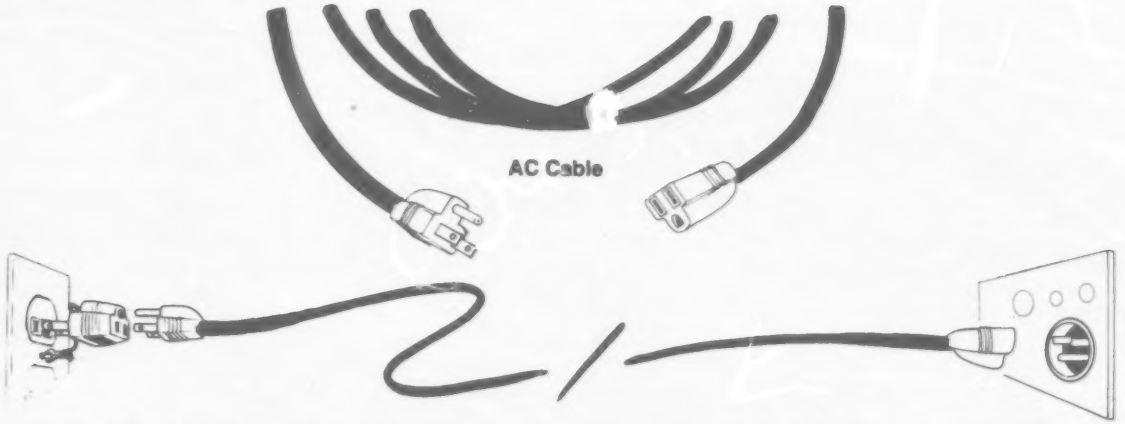
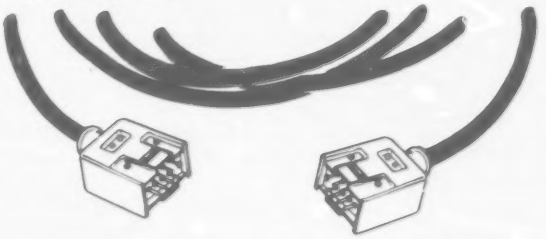
1. AC or POWER CABLE



The POWER CABLE supplies 117-120 volts AC only to the VTR. It may be connected to any grounded 117-120 Volts AC, 60 Hz wall socket. Older 2-prong wall sockets will necessitate a 3- to 2-prong adaptor, available at most hardware stores.

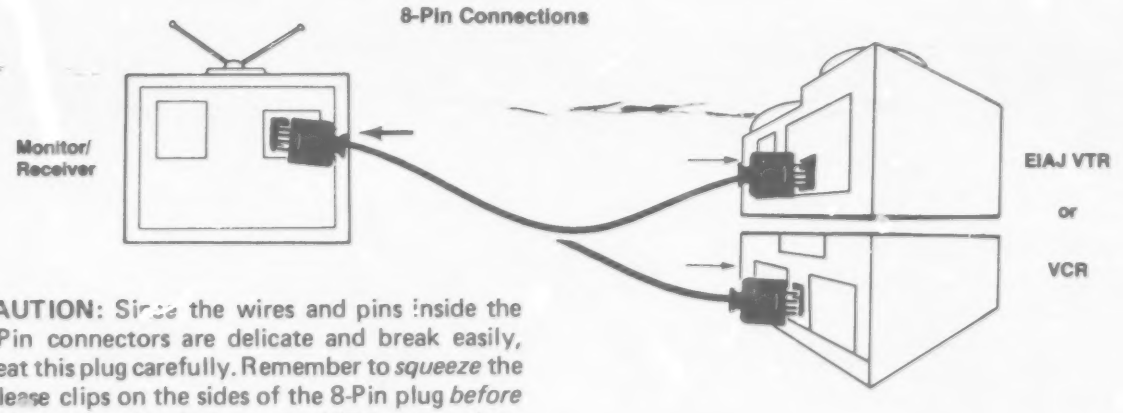
NOTE: If any interference is present in the picture (wavy lines) or in the audio (hum or buzz), make sure the GROUND wire (green wire) on the 3- to 2-prong adaptor is grounded (connected) to a metal pipe or to the screw that fastens the plug to the wall socket plate.

2. Monitor/Receiver 8-Pin CONNECTOR

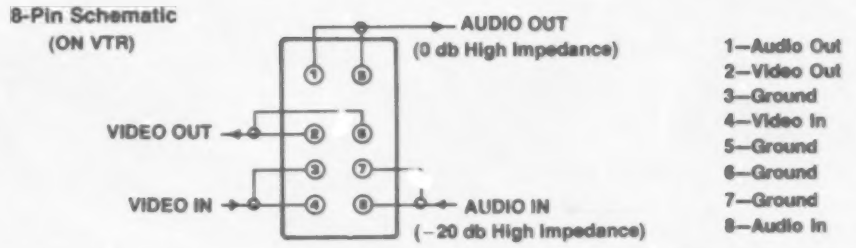


Use the 8-Pin to 8-Pin connector and cable to join the VTR to the monitor/receiver. The 8-Pin carries:

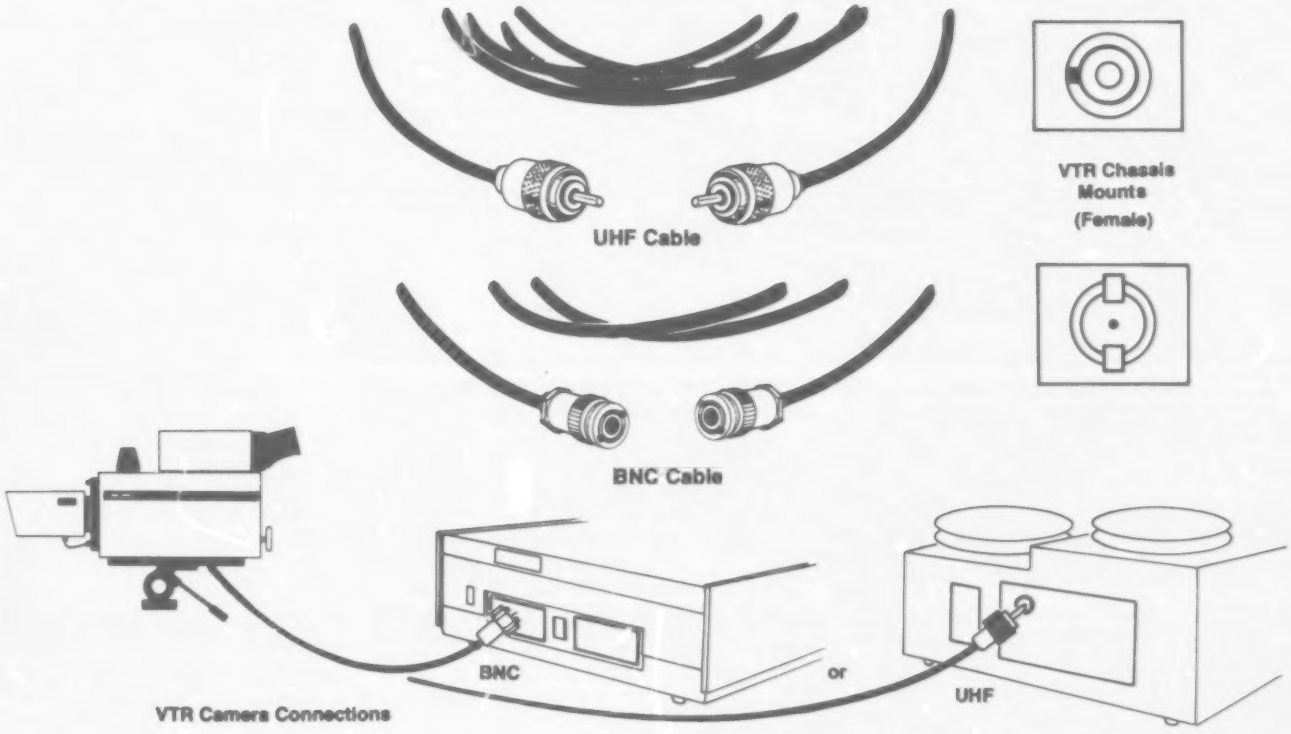
- Picture and sound from the VTR to the monitor.
- Picture and sound from the TV monitor/receiver to the VTR during an "off-air" recording.



CAUTION: Since the wires and pins inside the 8-Pin connectors are delicate and break easily, treat this plug carefully. Remember to *squeeze* the release clips on the sides of the 8-Pin plug *before* trying to unplug it from the VTR or monitor.



3. CAMERA and VTR Connectors



There are many different kinds of camera cables, but the most basic and universal is called the COAX or COAXIAL cable. This cable is a 2-connector type that uses a simple metal male-type connector on each end. The cable may use either a screw-on UHF (Ultra-High Frequency) plug or a BNC (bayonet) type connector.

UHF connectors are generally found on most nonbroadcast VTRs, cameras and monitors, while the BNC connectors are used exclusively with broadcast video equipment. The BNC connector permits faster connection and a sure locking grip.

If making up your own cables, be sure to specify RG-59U cable. This is the standard size used in all video systems. The UHF and BNC plugs will fit easily on the RG-59U cable. This cable is very rugged and so are the connectors. It carries only picture information—no sound.

The coax cable is used for:

- Camera to VTR
- VTR to VTR
- Monitor to VTR and return
- Camera to SEG (Special Effects Generator)
- Camera to Monitor

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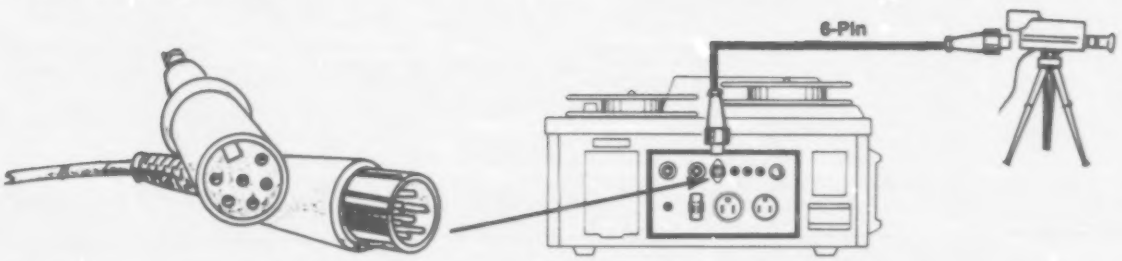
A BARREL CONNECTOR is used to connect 2 cables together, and the T-CONNECTOR will allow 2 cables to be connected to one plug.

UHF Barrel

UHF "T"

BNC "T"

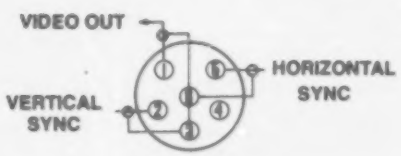
Sony 6-Pin or DIN Plug



Many ½-inch reel-to-reel VTRs have a special 6-PIN DIN (German part reference) plug which was originally intended for use with the basic b&w Sony studio cameras. This plug is a hold-over from the pre-1971 Sony cameras which required the VTR to generate its own sync pulses and "drive" the camera. Also, the 6-Pin connector allows use of the CMA-2 and CMA-4 Sony portapak camera adaptor. *See Chapter 12—How to Take it With You—The Video Portapak.*

Most cameras will operate just as well without the 6-Pin cable. Instead, use the stronger and simpler camera coax (UHF) cable which does the same job. Both the 6-Pin cable and UHF cable generally transfer picture *only* from the camera to the VTR. However, because it is plastic, the 6-Pin plug breaks easily and is a nuisance to repair.

NOTE: If using b&w cameras with a video mixer or SEG (Special Effects Generator), you may need the 6-Pin plug to supply horizontal and vertical sync pulses from the SEG to the camera and to take the picture from the camera (VIDEO OUT receptacle) to the SEG.



6-Pin Schematic

6-Pin Connector

1. VIDEO OUT	2. VERTICAL SYNC	5. HORIZONTAL SYNC
6. GROUND	3. GROUND	6. GROUND

Mini-Plug

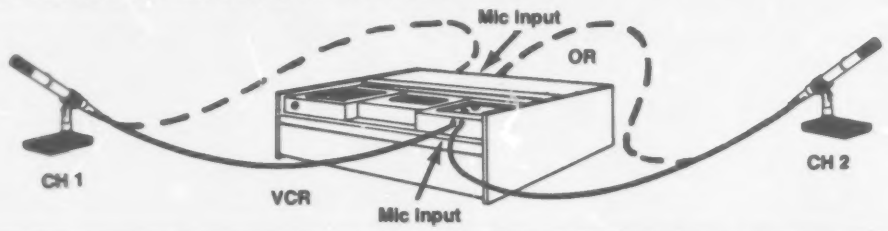
Phone Plug

4. Microphone Connections

There are two popular types of microphone plugs in common use, the Sony MINI-PLUG, used with nearly all ½-inch and ¾-inch Sony VTRs, and the ¼-inch PHONE PLUG which is used with many non-Sony VTRs. The ¼-inch phone plug should not be confused with the ¼-inch Akai video systems. Adaptors can be purchased from audio or electronic stores to adapt one kind of plug to another.

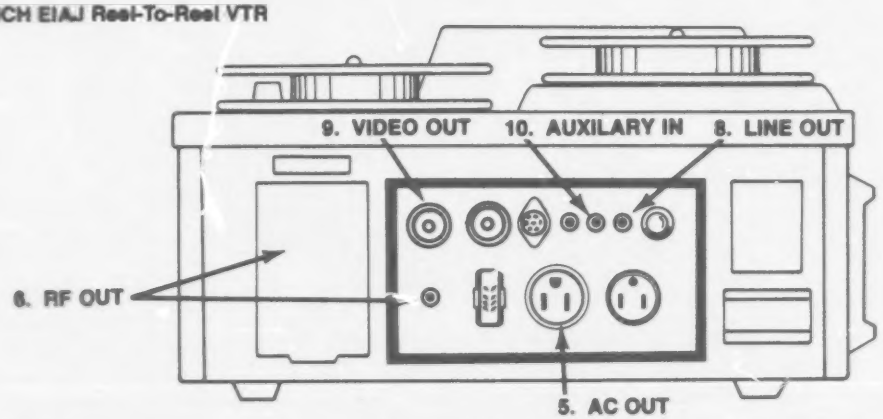
Use any good quality LOW IMPEDANCE (measure of resistance) microphone. Low Impedance microphones are usually the more expensive types—priced from $15 up. The supercheapie $5 to $10 HIGH IMPEDANCE microphones just aren't very good. It's well worth the investment to spend $25 to $40 for a good CONDENSER type microphone. Condenser microphones are very sensitive, use batteries and are really great for voice and low-volume music. You will probably need both a UNI-DIRECTIONAL microphone which has a narrow field of sound pickup for interviews and hand held applications, and an OMNI-DIRECTIONAL microphone (lavelier type) with a wide field of pickup for sit-down discussion applications.

Plug the microphone (or microphones) into the MIC INPUT in the back panel of the ½-inch reel-to-reel VTRs or the front panel of the ¾-inch and Betamax videocassette units. The sound should be clean and strong and without distortion.

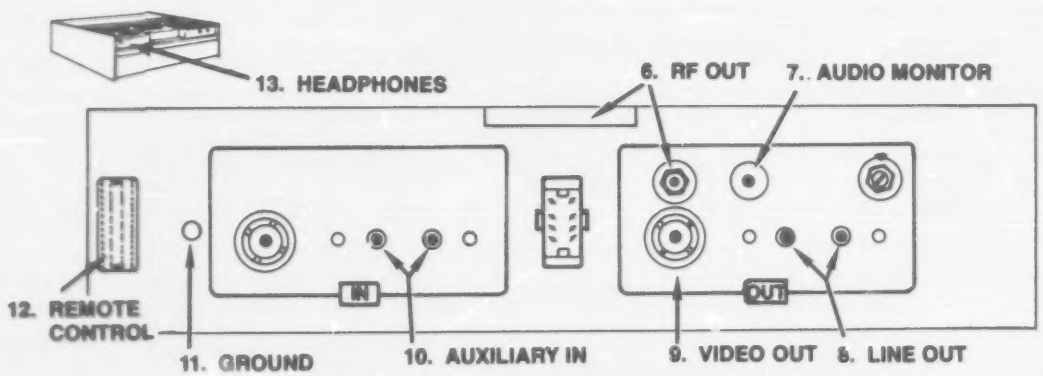


SECONDARY CONNECTIONS

½-INCH EIAJ Reel-To-Reel VTR



¾-Inch VCR



5. AC OUT

AC OUT is an extra AC outlet for camera or monitor power plugs.

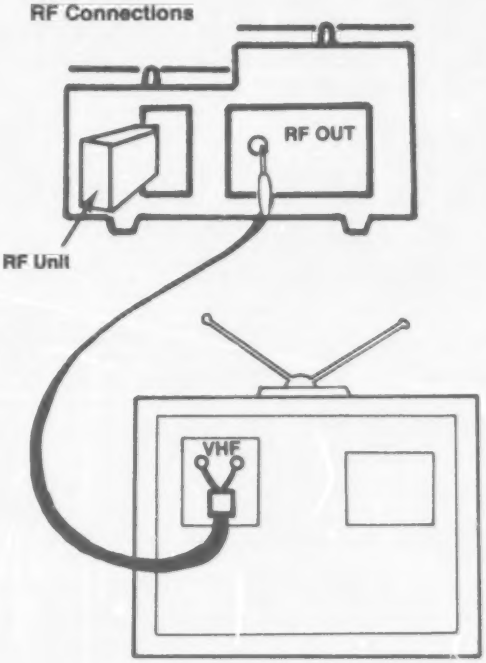
CAUTION: *DO NOT* connect any lights to this plug as its power rating of 500 watts could easily be exceeded and the fuse in the VTR would blow out.

6. RF OUT

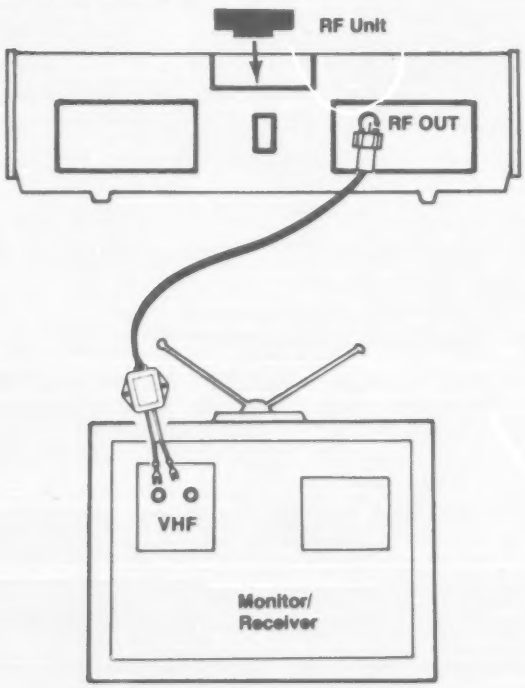
RF OUT (Radio Frequency) is used to play back BOTH picture and sound through an ordinary TV set. To activate the RF OUT connector, the VTR must contain an RF ADAPTOR, which is usually optional. Most early model Sony and Panasonic ¾-inch U-MATICS, and Panasonic and Hitachi-Shibaden ½-inch EIAJ Cartridge machines (Omnivision) contain built-in RF units.

The optional RF module costs about $80 for b&w and $120 for color and must be plugged into the appropriate slot in the back of the VTR. The RF cable and TV antenna connector are then attached to the VHF TERMINALS of any ordinary TV set. The TV set is tuned to the same channel as the RF unit—usually Channels 3, 4 or 5. Check the RF module or the back of the VTR for the channel number. Usually, the TV set must be fine tuned to the specific channel for best picture and sound.

EIAJ ½-Inch RF Connections



¾-Inch U-Matic VCR



NOTE: RF units and TV sets often do not work as well for play back as monitor/receivers do. Sometimes, RF units (especially those in ½-inch EIAJ VTRs) do not work with certain pre-1975 American TV sets. Always try to use Sony Trinitrons or other quality Japanese TV sets when using RF units, especially when playing back color programs. A standard Sony Trinitron TV receiver will give you the best color playback—other than a Trinitron TV monitor.

Interchangeability of RF UNITS

Only certain VTRs can use RF units. All EIAJ b&w VTRs of the *same* manufacturer can use an interchangeable RF unit. For example, the Sony AV-3400, 3600 and 3650 all use the same b&w RF unit, but only the out of production AV-8600 and AV-8400 can use the color RF units. The AV-8650 WILL NOT accept any RF units. Most Sony Type II Videocassette units can accept color RF units, but some cannot. Check for the RF plug outlet on the back panel of the unit.

Assembling RF Connectors

No soldering is required with RF connectors. They are called TYPE "F" or CABLE TV connectors. Be sure to use RG-59U cable.

Step 1 Strip cable, and expose center wire.

Step 2 Insert connector.

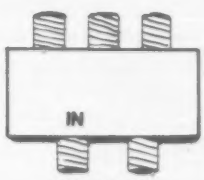
Step 3 Crimp ring

RF Cable Connectors

Cable TV Transformer
750-300 ohms

Barrel

2-Way Splitter



4-Way Splitter

NOTE: see *RF Systems, Chapter 8—TV Monitors and Video Projectors*

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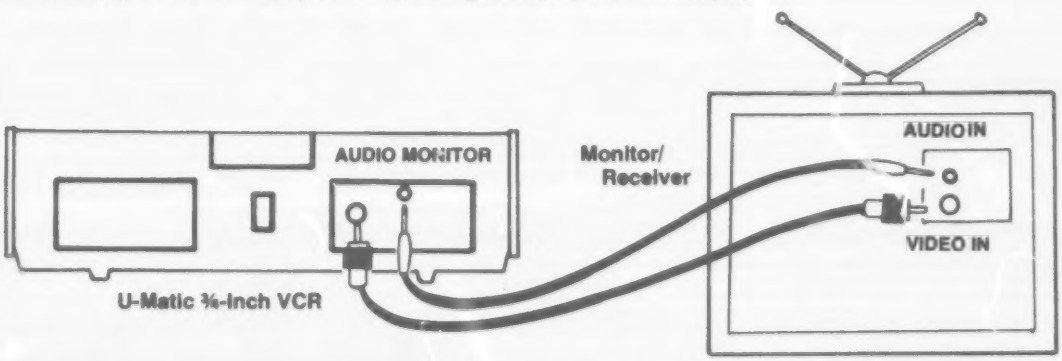
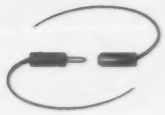
7. AUDIO MONITOR—¾-inch U-Matic only

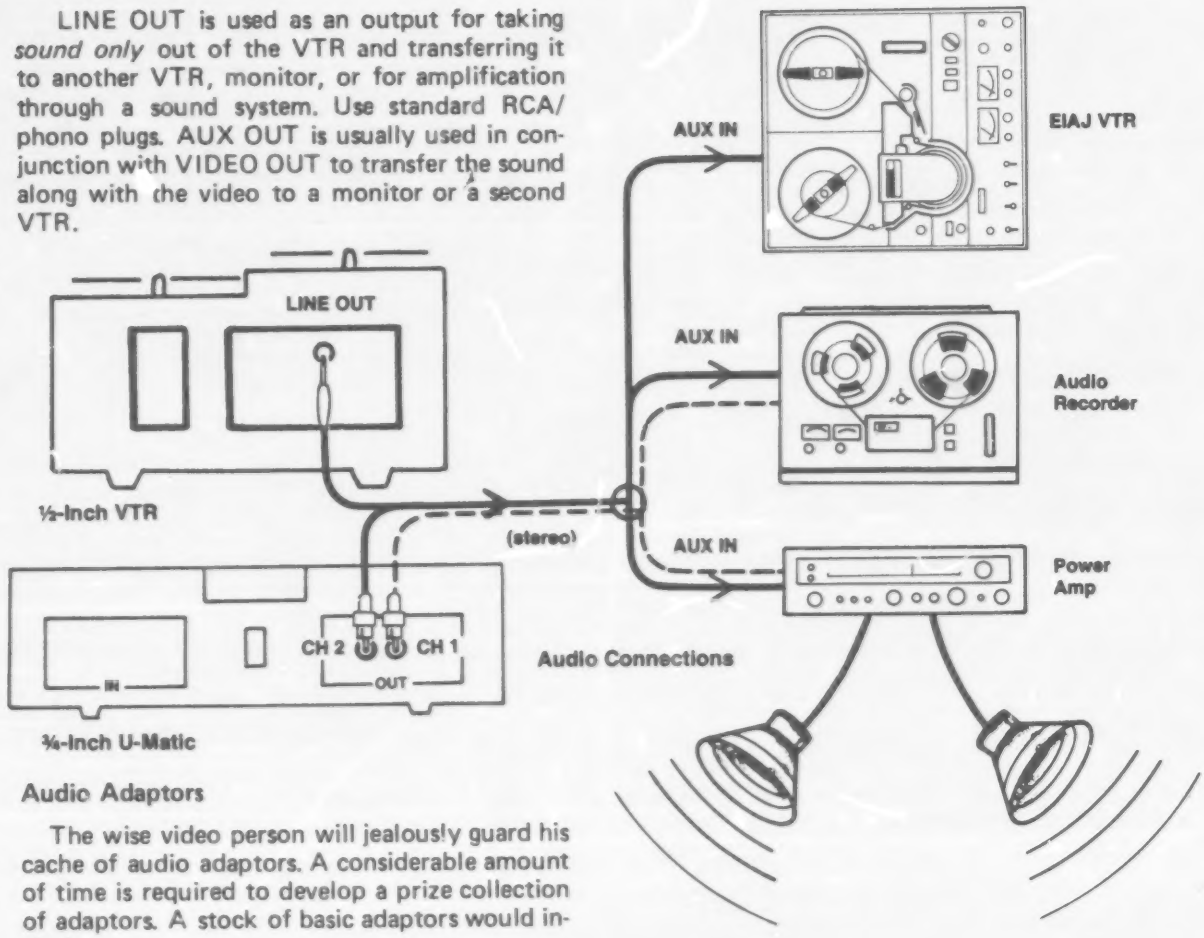
Use this plug as another way of transferring sound to a TV monitor.





8. LINE OUT

LINE OUT is used as an output for taking *sound only* out of the VTR and transferring it to another VTR, monitor, or for amplification through a sound system. Use standard RCA/phono plugs. AUX OUT is usually used in conjunction with VIDEO OUT to transfer the sound along with the video to a monitor or a second VTR.



Audio Adaptors

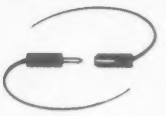
The wise video person will jealously guard his cache of audio adaptors. A considerable amount of time is required to develop a prize collection of adaptors. A stock of basic adaptors would include:

Basic Adaptors Include:

·female ¼-inch PHONE to male RCA/PHONO

·female RCA/PHONO to male ¼-inch PHONE

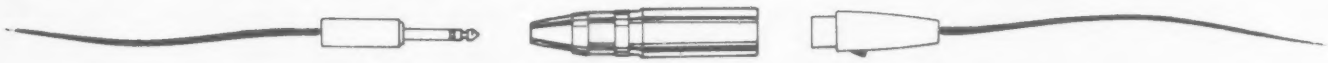
·female ¼-inch PHONE to male MINI



·female RCA/PHONO to male MINI

·female MINI to male ¼-inch PHONE

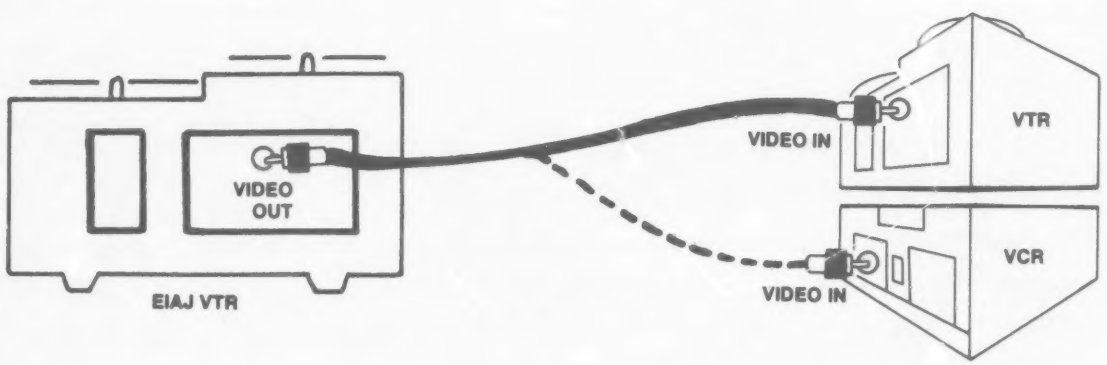
·female PHONE to male CANNON

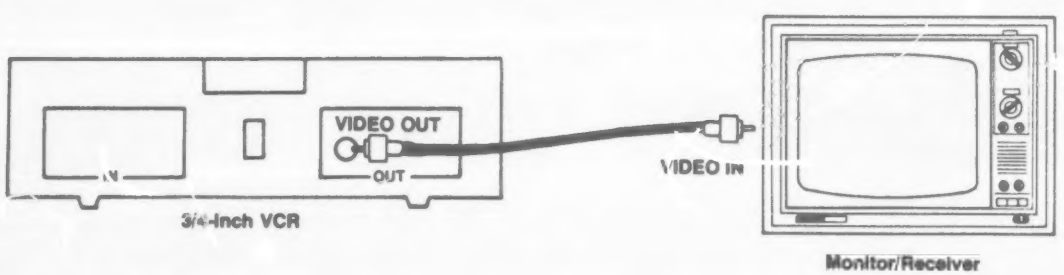


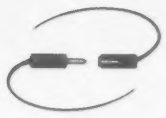
·RCA/PHONO Y-CABLE (male and female)

9. VIDEO OUT

Use a UHF cable to connect one VTR to another, or to a TV monitor. VIDEO only is transferred OUT of the VTR and into a second VTR by means of this plug and cable.

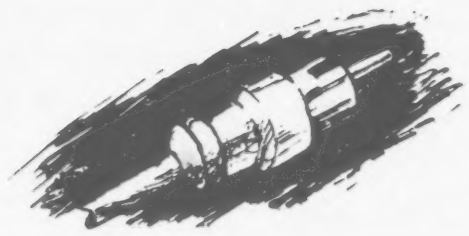






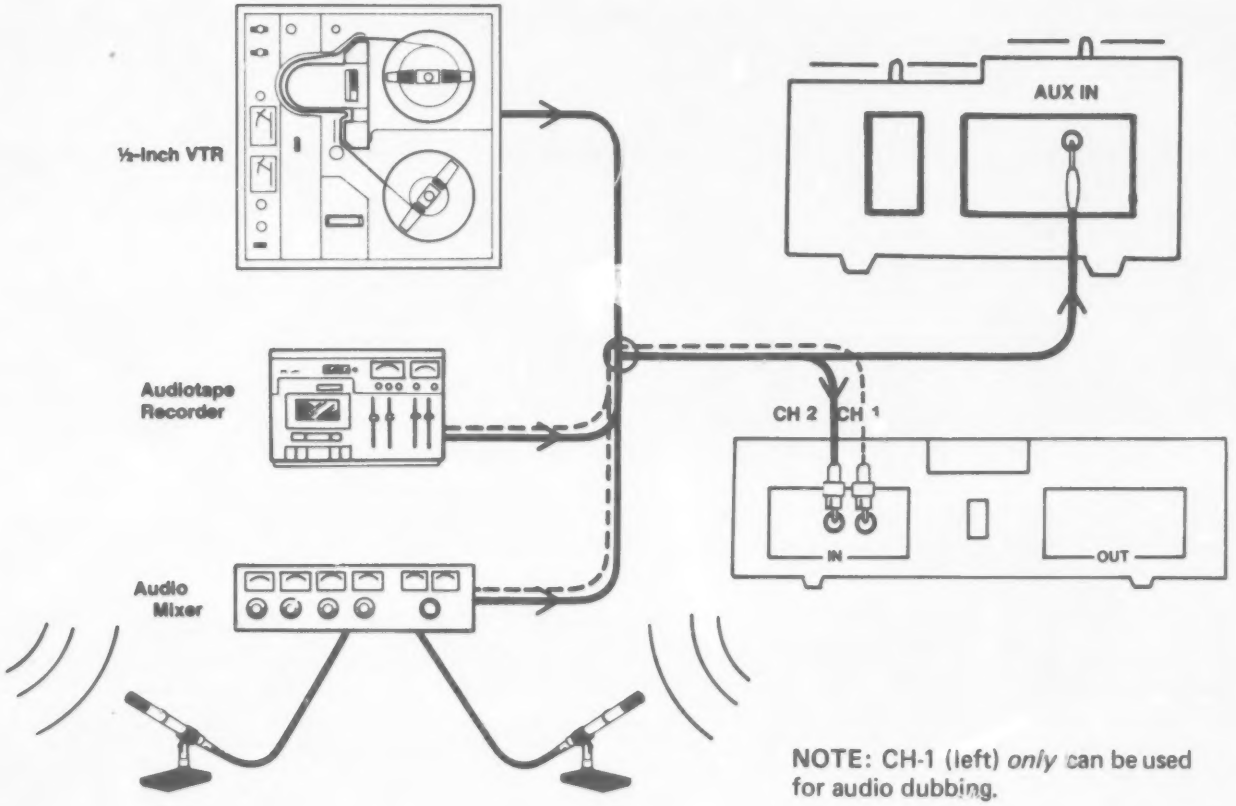
10. AUXiliary IN or AUDIO IN

AUX IN is used as an input for nonmicrophone sound sources only. Use it to transfer the sound from external sound sources such as other VTRs, sound mixers, stereo amplifiers, or audio cassette or reel-to-reel player/recorders. A microphone *will not work* in this input because the impedance (resistance) of the input is different. Use an RCA/PHONO plug and cable for sound connections.



RCA or Phono Plug

AUXILIARY SOUND CONNECTIONS



NOTE: CH-1 (left) *only* can be used for audio dubbing.

11. GROUND—If a hum is present in the audio, connect a wire from here to a metal surface.

12. REMOTE CONTROL CONNECTOR—¾-inch U-Matic models only

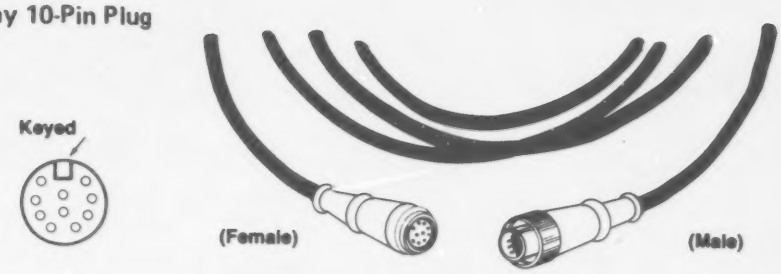
Use with RM-410 REMOTE CONTROL unit (all Sony VO-2000 Type II models) or with RM-400 AUTOMATIC EDITING PROGRAMMER (Sony VO-2850). *See Chapter 11—Understanding Basic Videocassette Recorders.*

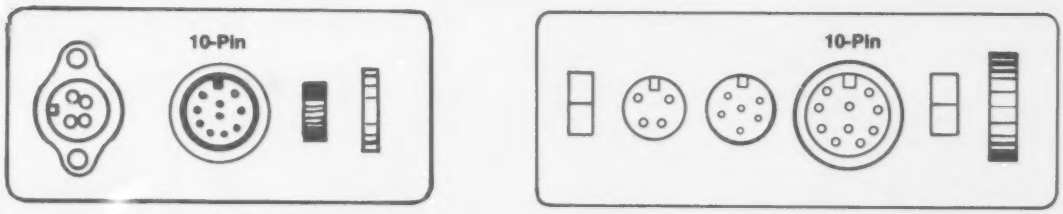
13. HEADPHONE INPUT

Use standard 8-ohm headset. Select correct level with level switch if available.

OTHER PLUGS AND WIRES

Sony 10-Pin Plug

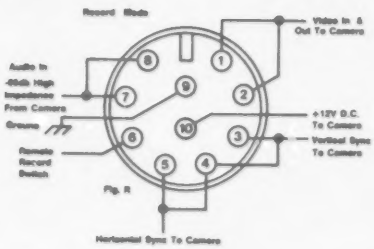


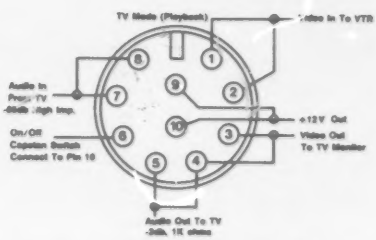


AV-3400 AV-8400S

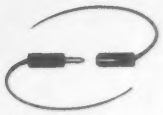
The 10-Pin plug is used primarily to connect portable b&w cameras to the appropriate portable b&w VTR. It also is used to connect a color camera (such as the Sony DXC-1600) to its Camera Control Unit (CCU). Other manufacturers such as Hitachi-Shibaden, JVC and AKAI also use the 10-Pin cable to connect their color cameras to a portable VTR or CCU. Notice that the 10-Pin plug is notched so it will only fit into the plug on the VTR in one specific way. Be sure to carefully and properly line up the plug with the connector.

10-Pin Schematic





NOTE: The 10-Pin plug is very delicate and should be treated with extreme care. The soft aluminum casing can be bent easily, making it difficult to plug into the VTR; or worse, pins can be broken externally or internally, thereby shutting down the camera or making the VTR useless. Due to their small size and densely packed internal wiring, you should not attempt to modify or repair a 10-Pin plug unless you have the hand of a surgeon, the eye of a jeweler and the experience of an electronic technician. The plugs are also expensive—about $10 each!



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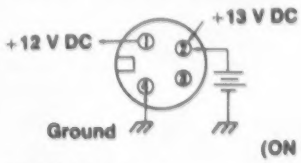
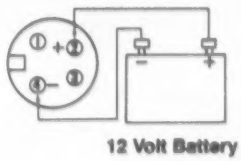
Sony 4-Pin or DIN Plug

This plug is used to supply 12 Volts DC power from either an external battery or from the AC power adaptor to the portapak.

CAUTION: Improper polarity (+ or -) connections will burn out the VTR. Also DO NOT apply more than 12 volts DC to the VTR.



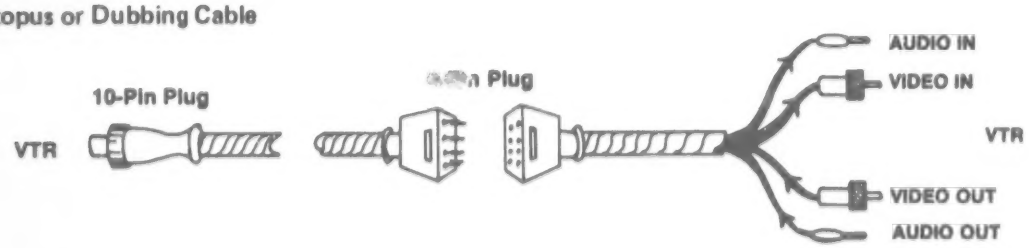


The XLR or CANNON Plug

The XLR or CANNON plug is the standard of the Broadcast industry. It is the strongest and most dependable audio plug made. All broadcast ¾-inch, 1-inch and 2-inch VTRs use the XLR plug for all audio applications. It has 3 pins inside it, but you will only need to use 2 for simple applications with small-format equipment. Some video users replace the microphone mini-plug on the front of the portapak with an XLR CHASSIS MOUNT (flush mount) type plug and adapt their microphone cables to XLR male and female connectors.

The VTR modification requires careful cutting and drilling to fit the plug into the portapak. XLR plugs enable you to use most standard microphone cables and also to avoid pulling cables apart and out of the VTR while shooting, since the plugs lock in place.

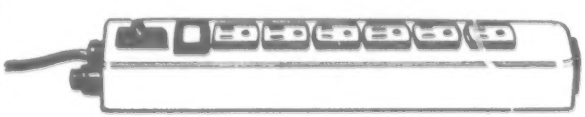
Octopus or Dubbing Cable



The OCTOPUS Cable or Dubbing Cable is an all-purpose connector cable that can be either home-made or purchased. It is invaluable for editing with ½-inch portapaks, the old Sony CV-series VTRs or the VO-3800 ¾-inch portapaks which lack the full assortment of video and audio input and output connectors.

Plug Strips

Use multiple-output socket AC plug strips for your lights, VTRs, monitors and cameras.



NOTE: It's best to get the ones with the 3-prong plugs, interchangeable fuses, and ON/OFF switches with lights in them. These deluxe strips are a little more expensive, but well worth it.

CARE OF CABLES AND CONNECTORS—DO'S AND DON'TS

DO'S

DO keep connections clean and free from dirt.

DO color code or mark all cables that belong to a system and perhaps attach a list of accessory equipment items. This prevents loss.

DO keep a good stock of extension cables for power cords, microphone cables and video cameras.

DO keep a sufficient stock of adaptors handy for audio and video connections.

DO use the most expensive and best metal jacks and plugs you can buy when making your own plugs—i.e., AMPHENOL or SWITCHCRAFT.

DON'TS

DO NOT break a prong on a plug—the equipment will not work.

DO NOT bend the cables excessively. This will weaken the cable and tear the wires from the plug. *Coil* all wires in a 12 to 15-inch loop.

DO NOT drop a plug end on the floor, or step on the plugs. This will weaken and eventually break them.

DO NOT lose cables. Replacement cables are expensive and sometimes impossible to locate on short notice.

Replacement of Parts and Connectors

Occasionally a well-stocked TV-Radio store like Lafayette or Radio Shack will have some replacement video and audio connectors, but first try the local video distributor. Another option is to go directly to the video manufacturer's warehouse if there happens to be one nearby. You could also send for the part from the factory, but it may take weeks or months.

When you do attempt to replace a connector or a cable, be sure to take the item to be replaced with you or know the plug number or technical name, but even technical names are not specific enough sometimes due to the enormous variety. Verbally describing parts accurately is almost futile—"Well, you see, it has a little bulge about this big on the end that fits over this silver sleeve here..."

OR send for the catalog of "anything to anything" video and audio connectors, adaptors and accessories from:

Comprehensive
VIDEO SUPPLY CORPORATION
Northvale, N.J. 07647 • (201) 767-7890
Call Toll-Free — 800-526-0242 except in N.J. and Metropolitan N.Y.

They have a broad listing of connectors, plugs, cleaning kits, batteries, maintenance equipment, script forms, releases, microphone mixers, TV receiver-to-monitor conversion kits, tripods, lights, ARPs, "tweakers," etc. They have everything!

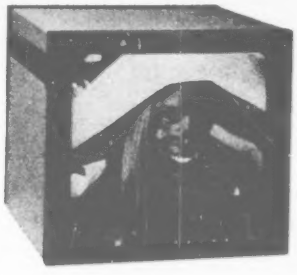
Another source for video equipment, supplies and accessories is WIDL VIDEO, 5325 North Lincoln Avenue, Chicago, Illinois 60625. They also distribute a catalog.

Chapter 8
TV Monitors And Video Projectors

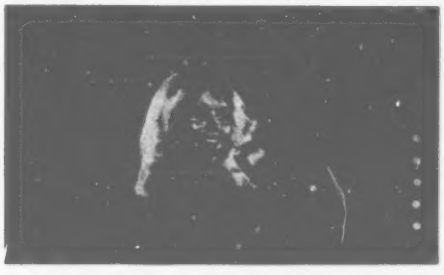
TV MONITORS

What's a Monitor?

The display element in the video system is of course the VIDEO MONITOR. Originally, a true video monitor was a must for any VTR playback, but since video has made substantial inroads into consumer and institutional marketplaces, TV RECEIVERS and MONITOR/RECEIVERS are now widely used with video equipment.



Model 5322

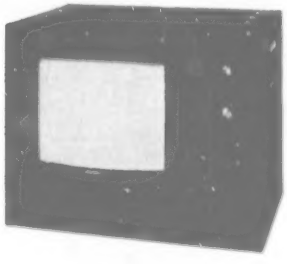


Model 5722

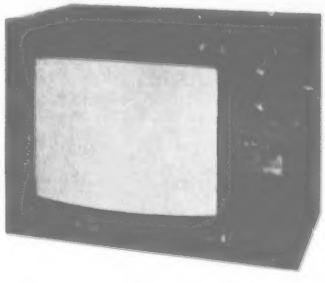
Conrac Monitors

The true video monitor plays back *picture only*—no sound. The standard of the broadcast industry is the CONRAC monitor which sells for about $5,000 for a 19-inch diagonally measured color monitor with all the "bells and whistles." Since these little gems are a bit expensive for the average video user and too complex and specialized to be really useful to him anyway, the practical alternative is the standard MONITOR/RECEIVER made by Sony, Panasonic, JVC, Hitachi, Electrohome, RCA, GBC, etc.

These units are basically high-quality TV receivers with special inputs and modifications that permit them to accept video and sound signals through the appropriate VTR, camera, and audio connectors. Monitor/receivers can reproduce *both* sound and picture. The monitor/receiver has become a standard piece of equipment and is now commonly referred to as a TV MONITOR or just MONITOR.



Sony CVM 1250



Sony CVM 2150

Monitor/Receivers

Monitor/Receiver Comparisons

A wide choice of monitors (monitor/receivers) is now available with b&w units ranging in price from $200 to $400, and color monitors costing from $250 to $1,500. Monitors should be compared on the basis of their features and picture quality.

Be sure to compare:

- Number of lines resolution—Is it "high resolution" (600-700 lines b&w, 350 lines color) or standard resolution (300-400 lines b&w, 250 color). The higher the resolution, the better the picture.
- Video and audio input/output connections—Does it have the ability to accept an 8-Pin VTR plug and other common video and audio connectors?
- Sound fidelity—How big is the speaker?
- Color quality—How good is the color?
- Accessories—Does it have AFT (Automatic Fine Tuning), a sharpness control, or other useful features?

Probable trade-offs of features for cost may have to be made if you want to save money. For a monitor standard to compare with, use any Sony monitor.

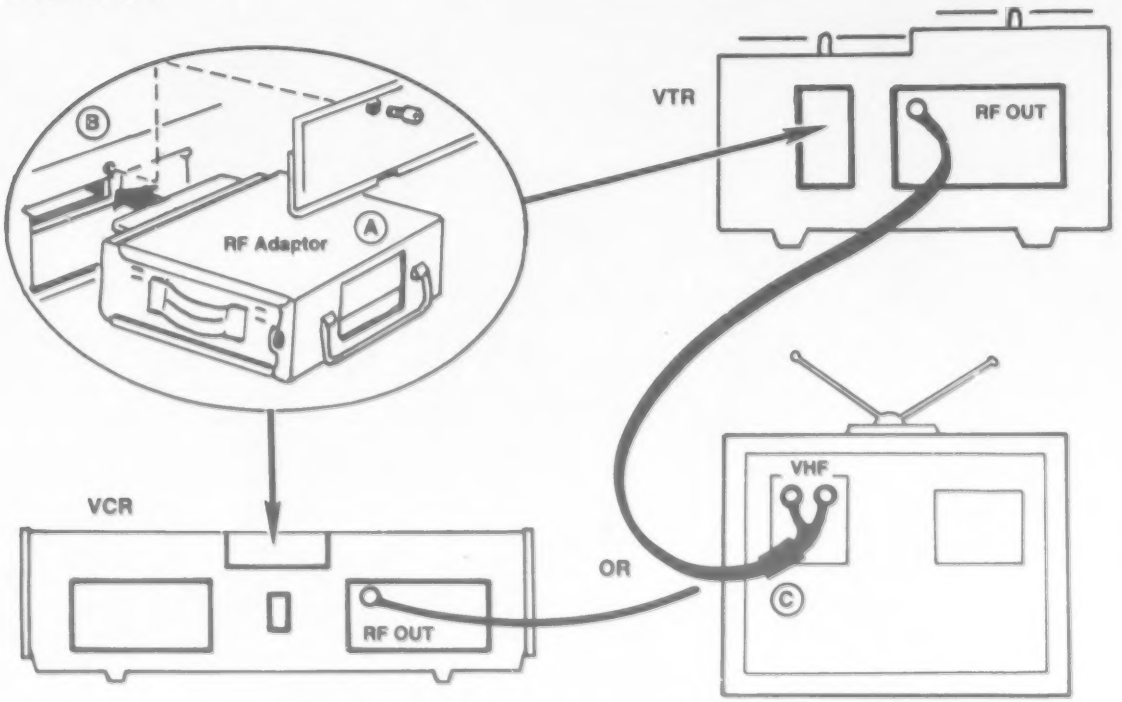
All 2-inch, 1-inch and most sophisticated ¾-inch and ½-inch master production VTRs require monitors for playback. At least 1 or 2 monitors are essential for serious video production and editing. They provide a viewing system for VTR playback and simple camera display. The monitor/receiver also allows you to record TV programs off-the-air and record them on any VTR.

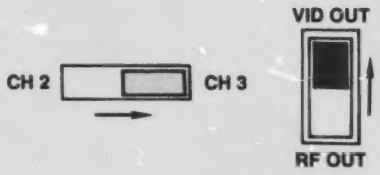
Use of Standard TV Receivers and RF Units

Standard TV receivers can be used with VTRs only if the VTR has either an optional or built-in RF MODULE or RF ADAPTOR. The RF Adaptor converts the video and audio signal from the VTR into a very low-power TV broadcast frequency which then can be accepted by any standard TV set. For example, a channel 2 RF Adaptor when connected to the VHF terminals of a standard TV set will "block out" the regular channel 2, and play back the videotape from the VTR on channel 2 on the TV set. Other TV channels will be unaffected.

NOTE: An RF Adaptor will only allow you to *play back* your tape on the TV set. The RF Adaptor will not allow you to *record* a TV program off-the-air from the TV set. To record off-the-air programs, you need either an external TV tuner or a monitor/receiver.

RF Connections

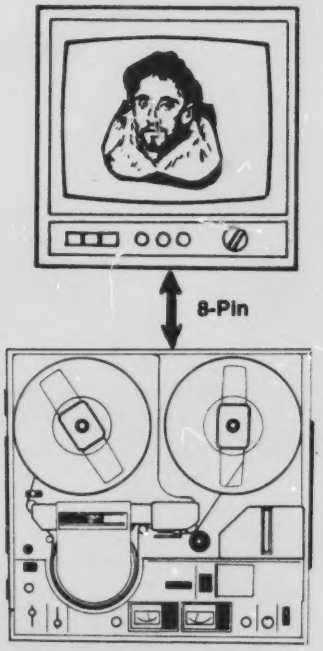


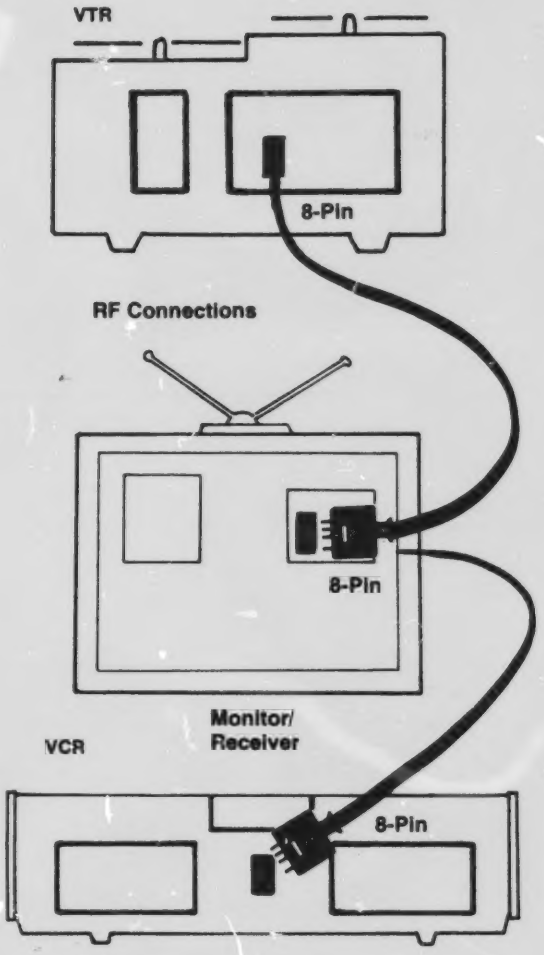


Use of RF Adaptors

Most RF units consist of a plug-in module (A) which fits in the back of the VTR (B) and a 75 ohm to 300 ohm standard cable TV type transformer that connects the RF cable to the VHF terminals on the TV set (C). RF units can be purchased for several different channels (you only need one). It's best to get one for a channel that *is not* being used in your local area, otherwise the local channel will burst in loudly when you turn off the VTR, creating an annoying amount of sound and a distracting picture. *See Chapter 7—RF OUT, Making the Right Connections.*

RF Adaptors are not standardized and take all kinds of shapes and sizes. Make sure you know what particular model RF unit is designed for your VTR. Many VTRs cannot use RF units. Check the VTR before you buy it. Look for the RF plug on the back of the VTR and check for an empty or full RF adaptor compartment. If the adaptor is not included, add $80 to $120 to the price of the VTR. If the VTR has a selector switch that provides a choice between two channels—i.e., Channel 2-Channel 3—that unit has a built-in RF Adaptor.





Connecting a VTR to a Monitor

Use the 8-Pin to 8-Pin cable to connect the VTR to the monitor. Plug one end of the 8-Pin cable into the receptacle marked TV on the VTR and the other end of the 8-Pin into the receptacle marked VTR on the TV monitor.

The 8-Pin cable carries *both* picture and sound both ways, from the VTR to the TV monitor and from the TV monitor to the VTR. This dual function allows VTR playback and off-the-air recording *only if* the monitor is a monitor/receiver.

VTR Playback on a TV Monitor

Step 1 Move the INPUT SELECTOR SWITCH on the monitor to the VTR or EXT (External) position. This switch should be located on the front, back, or side of the monitor.

Step 2 Play the tape on the VTR and adjust the monitor for the best sound and picture quality.

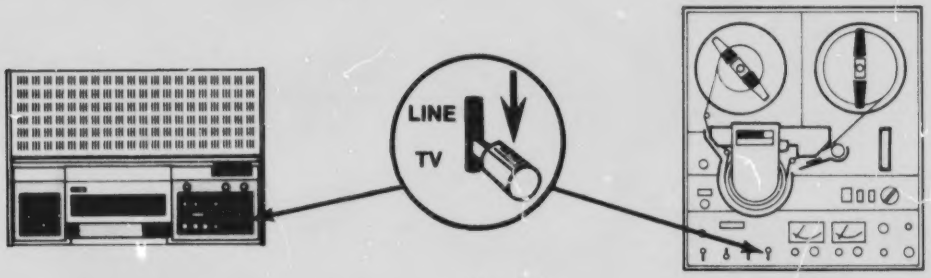
Off-The-Air Recording on the VTR

Step 1 Connect the 8-Pin cable to the VTR and monitor.

Step 2 Tune in the desired TV program on the monitor.

Step 3 Place a blank tape on the VTR.

Step 4 Set the VTR INPUT SELECTOR SWITCH to the TV mode.



Step 5 Push down the RECORD BUTTON on the VTR. Now turn the *MONITOR* INPUT SELECTOR to the VTR mode so you can monitor the picture and sound levels. The picture and sound now should be looping through the VTR and back to the monitor. This monitoring mode is called the E-TO-E MODE or ELECTRONICS-TO-ELECTRONICS MODE.

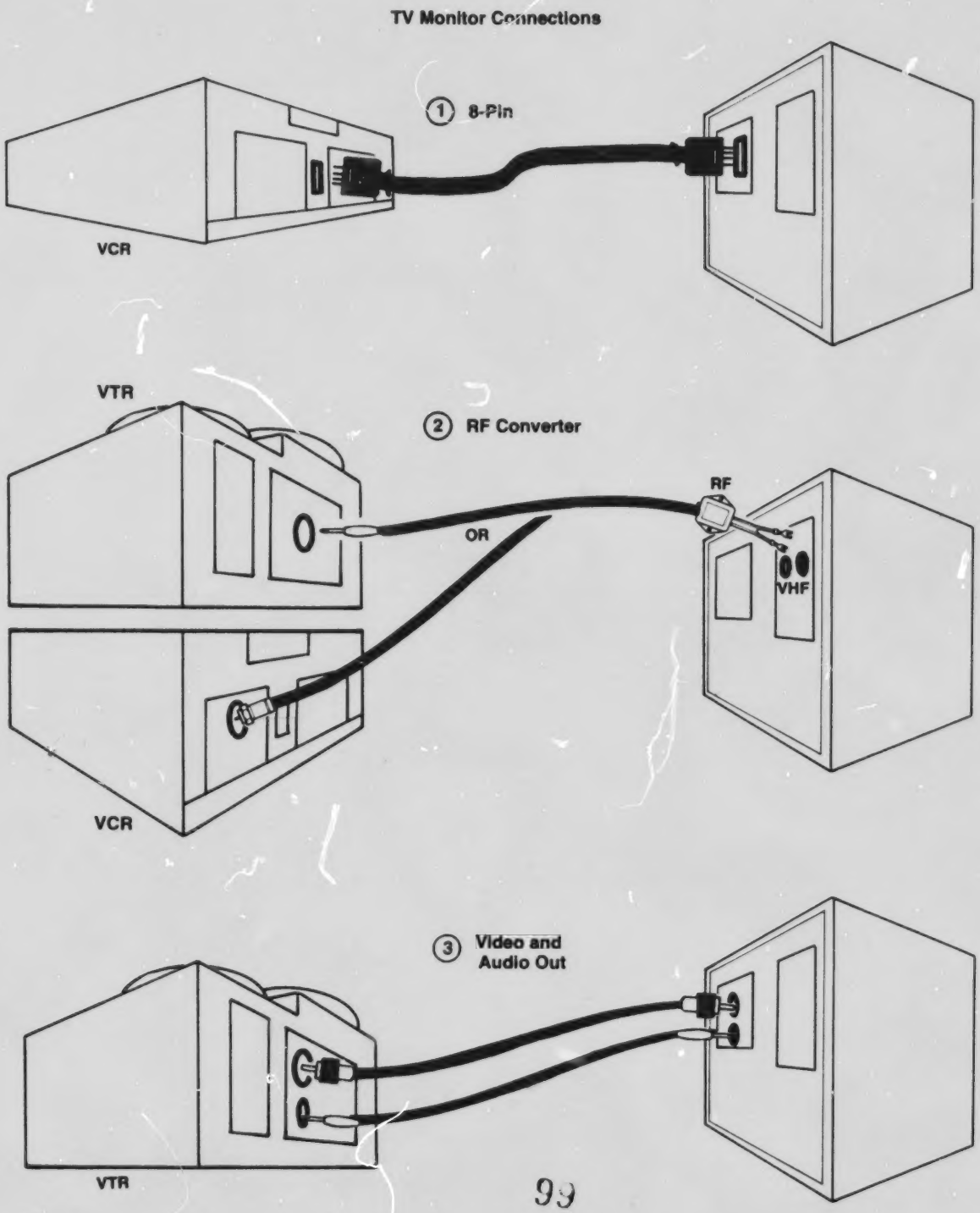
NOTE: Direct "E-to-E monitoring" only confirms that the signals are going through the VTR circuitry properly. It does *not* confirm that the VTR is recording properly on the tape. Only a tape playback will confirm that the VTR is recording correctly.

Step 6 Place the VTR in FWD (FORWARD) mode and record the program.

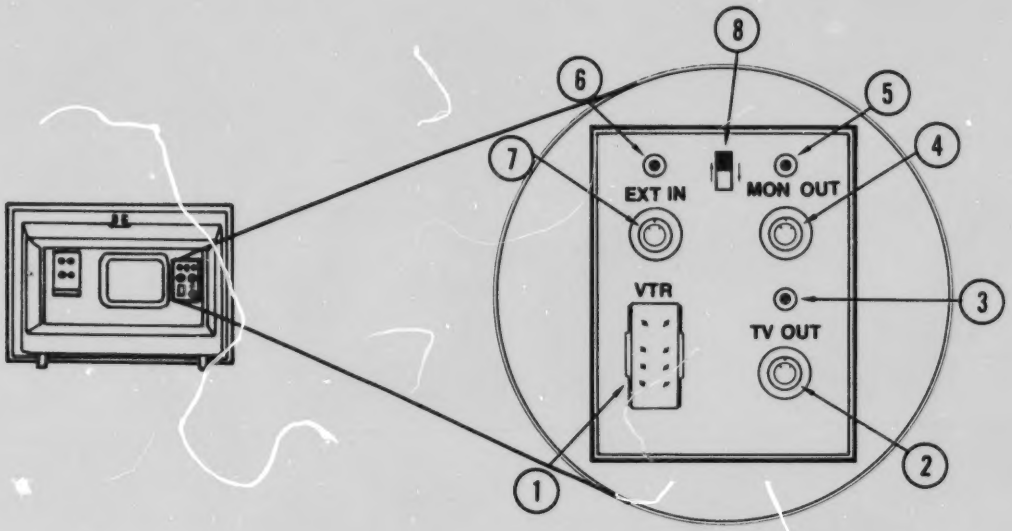
TV monitors come in various sizes, ranging from 9 to 25 inches, and in both color and black-and-white. TV monitors can be either portable or nonportable. Generally, a video production group will have several different size monitors, because portable units are better for transporting and for remote shooting, and large-screen units are better for group viewing.

TV Monitor Connections

There are 3 basic methods for connecting a TV monitor to a VTR:



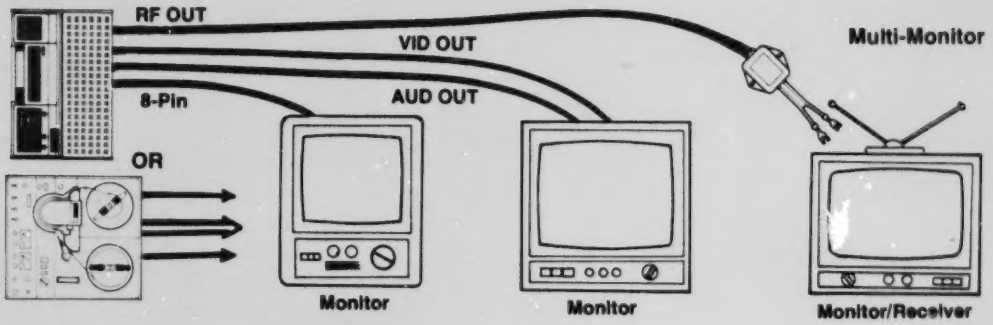
Most TV monitors have a multi-purpose input/output panel on the back of the unit.



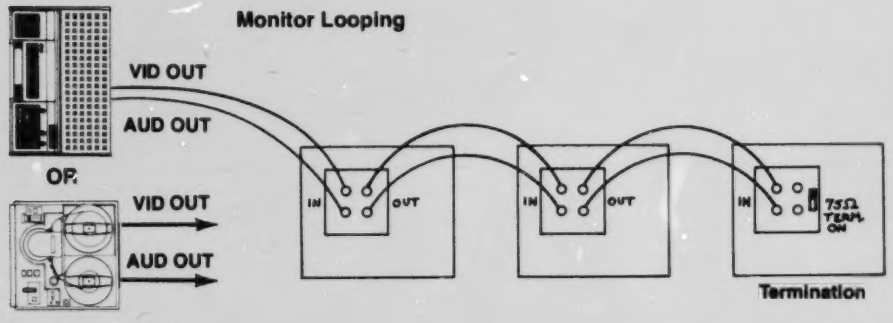
TV Monitor Connectors:

1. *VTR* 8-PIN—Connect an 8-Pin cable from this plug to any VTR. This plug provides full 2-way playback of picture and sound from the VTR to the monitor and allows off-the-air TV program recording of both sound and picture.
2. *TV OUT* — A *video output* — Connect a UHF cable from here to a VTR VIDEO IN plug if you are *not* using the 8-Pin plug and connector for this purpose. Use this output as an alternative way of recording off-the-air TV programs from the TV monitor.
3. *TV OUT* — An *audio output* which is used with the MON OUT (video) plug for an alternative way of recording off-the-air programs from the monitor.
4. *MONITOR OUT* — An *audio output* which is used for looping (continuing) the sound to another monitor or sound amplifying system.
5. *MONITOR OUT* — A *video output* which is used for looping the picture on to another monitor.
6. *EXTERNAL IN*—An *audio input*—Plug an audio cable from the VTR (LINE OUT) into this receptacle.
7. *EXTERNAL IN*—A *video input*—Plug the camera cable or a cable from the VTR (VIDEO OUT) into this receptacle.
8. 75 Ω (ohm) TERMINATION—Terminates EXTernal IN or VIDEO IN plug. If a camera or VTR is plugged into EXT IN or VIDEO IN, place the switch in the ON or 75 Ω position. If EXT IN and EXT OUT are both in use the termination is not needed and, therefore, change the switch to the OFF or UNTERMINATED position.

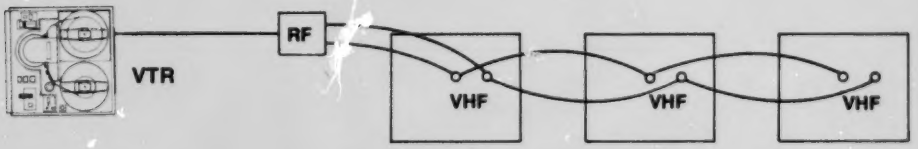
NOTE: Monitors always must be TERMINATED correctly to avoid degraded picture quality. Termination is a way of telling the video signals where to stop. It might be likened to a bumper on the end of a railroad siding. A wrongly terminated picture is usually indicated by excessive contrast in the picture.



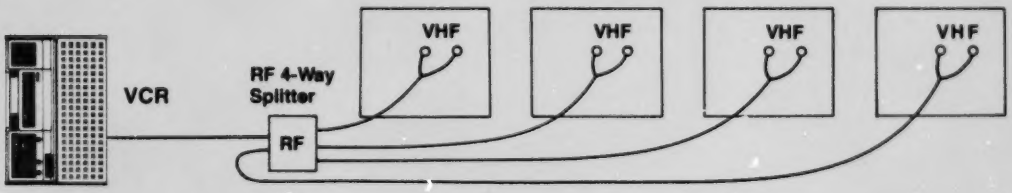
Monitor Looping



Generally, 4 to 6 monitors or TV sets can be connected to a single VTR before picture degradation is apparent. However, avoid long cable runs which can cause eventual picture loss if amplifiers are not used. If more than 6 TV monitors are to be connected, video and audio signals must be amplified. A DISTRIBUTION AMPLIFIER (for video monitors and monitor/receivers) or an RF AMPLIFIER (for TV receivers) should be purchased.



RF Multiple Connections



RF Multiple Receiver System

You also can connect multiple TV receivers or monitor/receivers together with an RF system. This is much easier than trying to run separate video and audio cables. You need a 2, 4 or 6-way RF SPLITTER and a corresponding number of 75-ohm to 300-ohm transformers and cables with type "F" RF plugs on each end. You will need one transformer for each TV receiver. The transformers cost only about $2.50 each, while the splitters are $6 to $10 each, depending on their size. They can be purchased at most TV/Radio stores. Tune all TV sets to the proper RF adaptor channel. *REMEMBER:* RF systems do not work quite as well as direct video connections.

DC Restoration

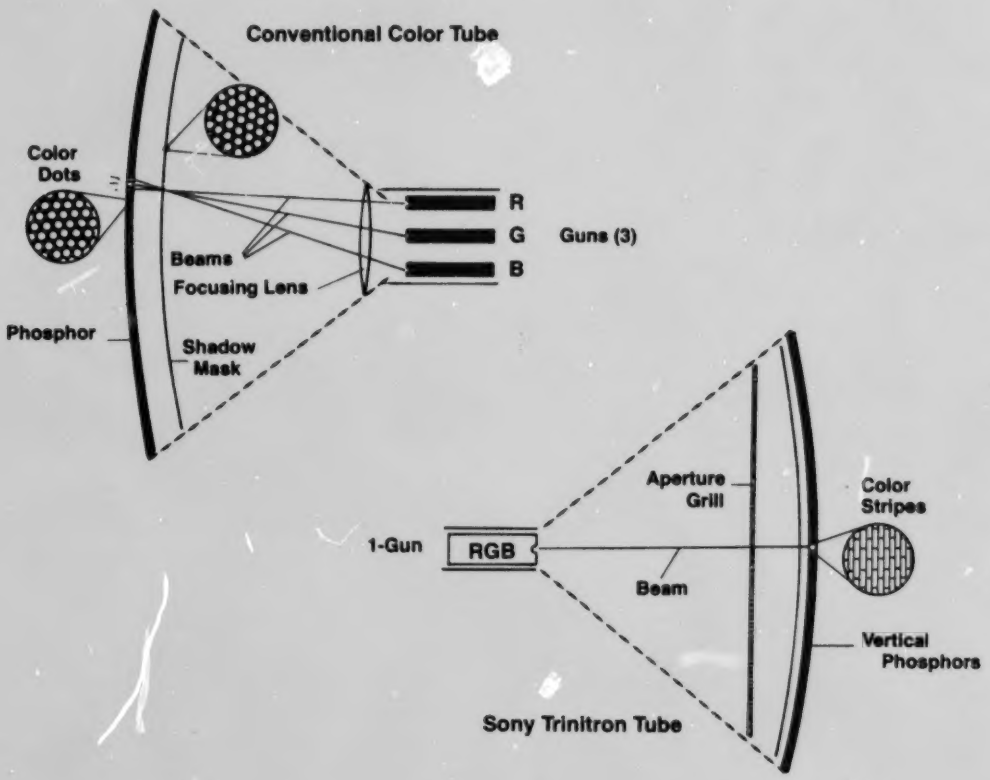
Always try to buy only cameras and monitors (monitor/receivers) that have DC RESTORATION circuits in them. Essentially, this is a circuit which restores the DC signal elements to the output of the camera or monitor. Without DC restoration, the picture will have uneven background shading, and whites and grays will merge together. Solid blacks and optimum contrast levels will be lost.

Color Monitors and Receivers

Conventional color monitors and TV receivers work by firing 3 separate electron guns (red, blue, and green) through a SHADOW MASK onto the phosphor coated face of the cathode ray tube (CRT). The mask is full of tiny holes and this helps to focus and control the beams so they strike only the appropriate red, green, or blue dots on the screen. The trouble with this system is registration—making sure each separate tube's signal is perfectly lined up with the other two.

The Sony Trinitron concept uses only a single gun that fires through a special APERTURE GRILL onto red, green and blue *vertical stripes* instead of dots on the CRT. Electron beam scattering and faulty convergence on the tube face is eliminated, and the resulting color quality has become the industry standard by which all other color TV sets and monitors are judged. Even the most expensive Conrac broadcast color monitors use the Trinitron TV tube.

The image deteriorates much faster in color than it does in b&w, especially when you are working with ½-inch and ¾-inch VTR systems and low cost color cameras. For this reason, it is very important to have a good color monitor so the picture will look as good as possible on playback. Also, if the color monitor does not display dependable and accurate color, there is no way of knowing whether or not the color camera or the VTR is working properly. Therefore, at least one quality color monitor is required for even the most basic of serious color video productions.



Costs of Color Monitors

Generally, color TV monitors cost twice as much as the comparable size standard TV receiver. By far the best color TV monitors are the Sony Trinitrons, which come in 8-inch, 12-inch, 17-inch and 25-inch sizes. They are expensive—about $800 to $950 for the 17-inch CVM-1750, but the Trinitron monitor is as close to color perfection and complete reliability as you can find, especially for the price. All Trinitrons have DC restoration circuits in them.

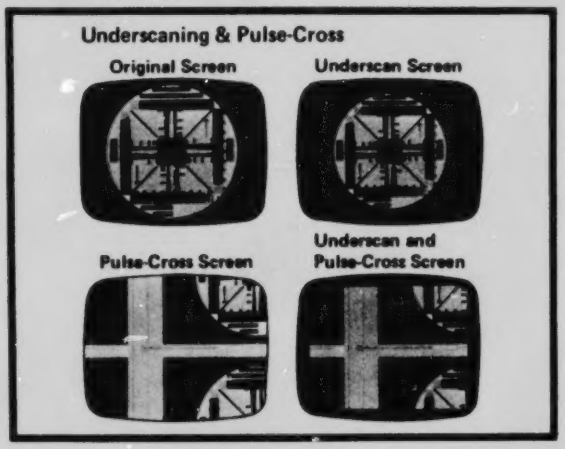
Less costly options include purchasing a used Trinitron monitor or buying one of the monitor converted Trinitron TV sets manufactured by AMTRON CO., P.O. Box 1038, Aptos, CA 95003. Another option is to have a skilled video or electronics technician convert a regular Trinitron TV set into a monitor for you.

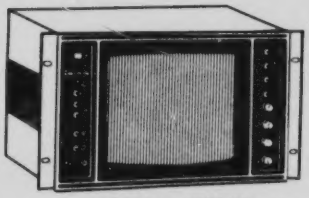
Special Trinitron TV to monitor conversion kits can be purchased for about $170 from Comprehensive Video Supply Corp. You will need to spend about $30 to $50 more for installation labor. If you can afford it—simply buy a new or good used Trinitron TV monitor.

Special Purpose Monitors

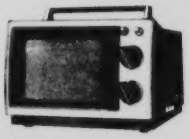
Certain specialized monitors are necessary for serious TV production, because they will reveal what is really happening to your video signal.

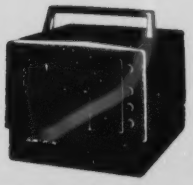
Most standard monitor/receivers are too "forgiving" of video and sync abnormalities. Thus, when your third generation (copy of a copy) tape gets played back on someone else's video system, the picture suddenly jumps and shakes and loses color—much to your surprise. "Well, it looked fine on my monitor when I was editing it," you remark apologetically.

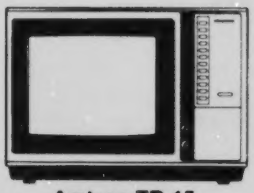


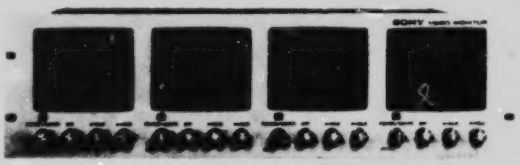

Amtron AM-12

Panasonic WV-5310


Amtron TR-8


Amtron TR-5
AC/DC Color Monitor


Amtron TR-15

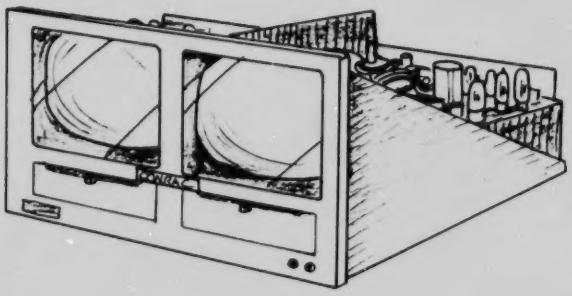

Sony PVM-400

In order to avoid the "third generation loss-of-sync blues," you should have at least one monitor in your system with the professional features of UNDERSCAN and PULSE-CROSS DISPLAY. A b&w monitor is perfectly sufficient for this purpose. Underscanning displays the entire image produced by the camera or VTR, including the edges of the picture which are normally cut off by standard monitors and TV receivers. The Pulse-Cross Display shifts the picture both horizontally and vertically to show the horizontal and vertical sync signals.

A Pulse-Cross display can reveal errors in VTR SKEW (tape tension), tracking, and time base stability. Pulse-Cross can also be used in editing to reveal out-of-sync edits, giving the user the chance to redo the edit so it does not carry on into successive generations of program material.

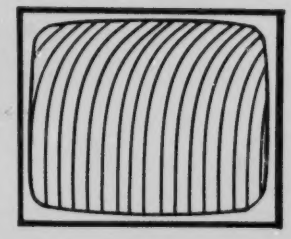
Panasonic makes a nice 9-inch 700-line high resolution b&w professional studio monitor (model WV-5310), with all these features and more. This unit is available in a single monitor desk-top style or in a 19-inch rack-mount version and each type includes an audio amplifier and an 8-ohm speaker.

One of the best checks for sync, skew, time base stability and tracking, is a very old tube-type Conrac monitor. I picked up an old set of double rack-mount 5-inch Conracs for about $80 many years ago and found them absolutely invaluable for editing and checking the stability of VTR and tape playbacks. Those old Conracs have such a slow or LONG AFC (Automatic Frequency Control) TIME CONSTANT that they lose their hold on the picture with anything less than perfect sync and tape tension (skew).

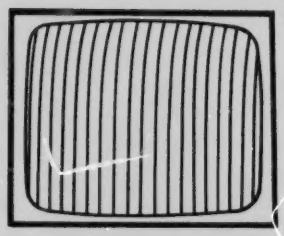


Old Conrac Monitors

Skew errors during VTR playback produce a timing error or time displacement of the horizontal sync pulses at the point where the picture playback from the VTR switches between the 2 video heads. This error causes the top of the image on the monitor to hook to the right or to the left depending on whether the video track has become too long or too short. Older monitors and TV receivers with a long time constant in their horizontal scanning circuits will cause the video to be displaced by as much as 100 lines, thus producing noticeable distortion at the top of the picture. *See Chapter 10–SKEW ADJUSTMENTS, Connecting the VTR.*



Long Time Constant



Short Time Constant

Extremely short or fast AFC time constants are used in all Japanese TV monitors and newer American TV sets which simply hide all those "black nastys" that lurk within the sync pulses and the control tracks on your master tapes.

There are several ways you can check out what's really happening on your tapes. You can purchase an OSCILLOSCOPE or WAVEFORM monitor (electronic test equipment), and/or find an old rebuilt Conrac video monitor ($120), or buy a good pulse-cross display monitor, or purchase an add-on pulse-cross conversion adaptor that will enable your monitor to function also as a pulse-cross display monitor.

Comprehensive Video Supply Corporation has a fabulous gadget that allows you to cope with the unseen horrors of skew and sync pulse error. It's called "The Tweaker," and it serves as a waveform monitor and pulse-cross display when used with a b&w or color monitor and also functions as a video distribution amplifier.

The waveform sampler permits measurement of the composite video signal, and the pulse-cross display repositions the monitor picture so you can see the sync and blanking pulses and VTR head switching point. This information then allows you to precisely adjust your VTR skew and tracking controls for optimum playback. For $395, "The Tweaker" would be a sound investment for any video production facility.

A pulse-cross monitor or a super-slow time constant monitor is good cheap insurance for editing, and it allows you to constantly check VTR skew and tracking adjustments. This prevents much trouble and disappointment later.

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VIDEO PROJECTORS

Advent Model 760

Most high quality video projectors will receive standard TV programs off-the-air and also allow playback of a VTR or video camera through the projector. The projector's image usually doesn't look as sharp as that on a standard TV set because of the projector's great picture magnification. This apparent loss in picture quality is created by the 525-line limitation of the American standard TV picture.

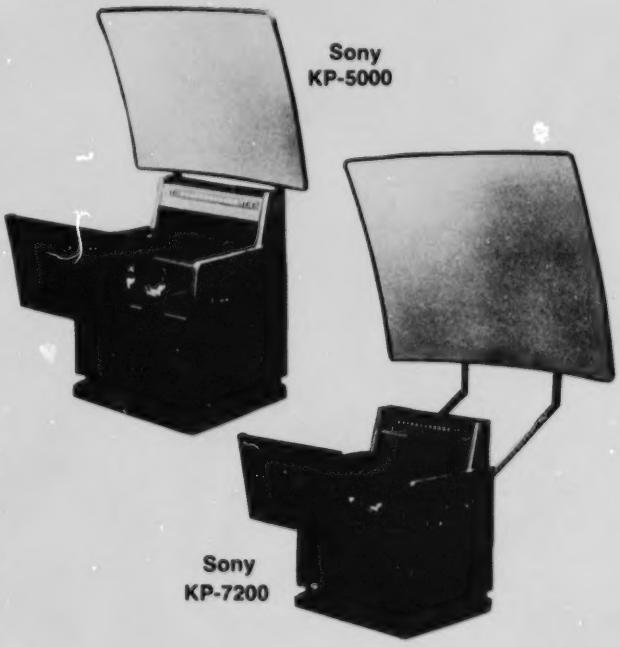
The larger the image, the greater the separations between the scanning lines, causing the picture to appear to be diluted or even out of focus, if you are too close to the screen. For this reason, a 9-inch or 12-inch TV image will always look better than a 25-inch picture at the same distance. The quality loss is particularly noticeable with a ½-inch VTR playback.

The same situation occurs in film when you try to blow up a Kodak instamatic picture to 11 x 14 inches or to poster size. Not much picture sharpness remains. A good quality video projector, though, will really overwhelm you and will provide a dazzling picture if you can secure high quality videotapes or if you have excellent Cable TV or antenna reception.

Types of Projectors

There are many kinds of video projection systems in use. Basically, they are divided into two main groups, the 2 or 3-tube projector type and the reflected TV set type. The quality of these two types differs substantially, and the newer systems are much better than the older models in terms of brightness, clarity, sharpness and color quality.

In 1973, Advent Corporation introduced one of the first practical relatively low-cost ($4,000) 2-piece video projectors called the Videobeam® Model 1000A. Other models then followed,such as the Model 750, Model 710, and the Model 760 which projects a clear, bright picture even in an illuminated room. The Advent system uses 3 separate projection tubes, one for each color—red, green and blue. The different color images are then combined on the screen to form a realistic image. The Advent systems vary in screen size from 5 to 7 feet, and costs range from $2,500 to $4,500.

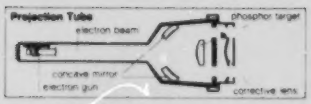


Sony KP-5000

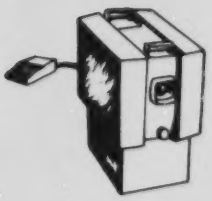
Sony KP-7200

Sony, Panasonic, MGA, Quasar, Sharp and GE all have various good quality projection systems available that differ somewhat in size and quality, and the prices are in the $3,000 to $4,000 range. The Panasonic, Sony and Quasar projectors deserve particular notice. GE has a unique rear-screen home TV projector but also makes a very sophisticated LIGHT-VALVE® video projector for large screens of up to 20 feet. The picture quality of this projector with a good tape approaches that of a 16mm film image. The big-screen GE projector ranges in price from $35,000 to $100,000.

Panasonic CT-6000V



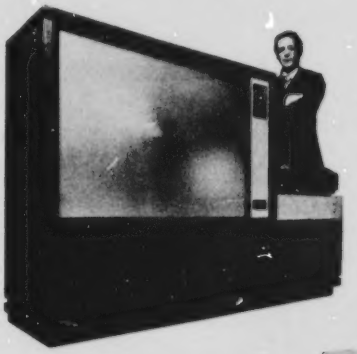
Projection Systems



General Electric Video Projector

Buying a video projection system requires the consideration of many factors such as image brightness, clarity, color quality, simplicity of operation, screen durability, rear screen vs. front screen projection, video and audio inputs and outputs, and of course price. Generally speaking, only the 2 or 3-tube type projection systems ($2,500-$3,500) are adequate for professional or large group use.

No doubt in the near future we will find the LED (light emitting diode) MATRIX video wall screens becoming popular and available. Then we will have achieved truly high quality large-screen video. These screens will *emit* video images with the brightness of a calculator or digital wrist watch instead of merely *reflecting* images as current video projectors do.



GE Widescreen 1000

MGA Video Projector

There are many low-cost TV projection systems now on the market, ranging in price from less than $1,000 for home TV kits to $300,000 for huge concert-hall systems. Before you buy, be sure personally to view in operation any projection system you might consider. If you can afford good equipment, video projectors can transform TV and video into a whole new dimension. It's like having a drive-in movie theatre in your own home. However, because the TV image is so enlarged, you will really notice the quality differences between videotape and film, and also the effect of good and bad lighting.

Experts predict that in several years, 10% of all new color TV systems being sold to consumers will be large-screen systems. Hopefully, the technical and creative content of the medium and the availability of low-cost videotape programming and hardware will improve sufficiently to make large-screen TV a worthwhile investment.

Chapter 9
VTR Interchangeability

The Variety of VTR Formats

Generally, all video cameras and monitors are basically interchangeable and will plug into any VTR and work. However, many VTRs *are not* interchangeable, which means that a videotape made on one type VTR will play back only on the same type of VTR. This lack of interchangeability is due to the different methods a particular VTR uses to record the various video, audio, and control tracks on the tape; the configuration of recording heads; and the speed and size of the tape.

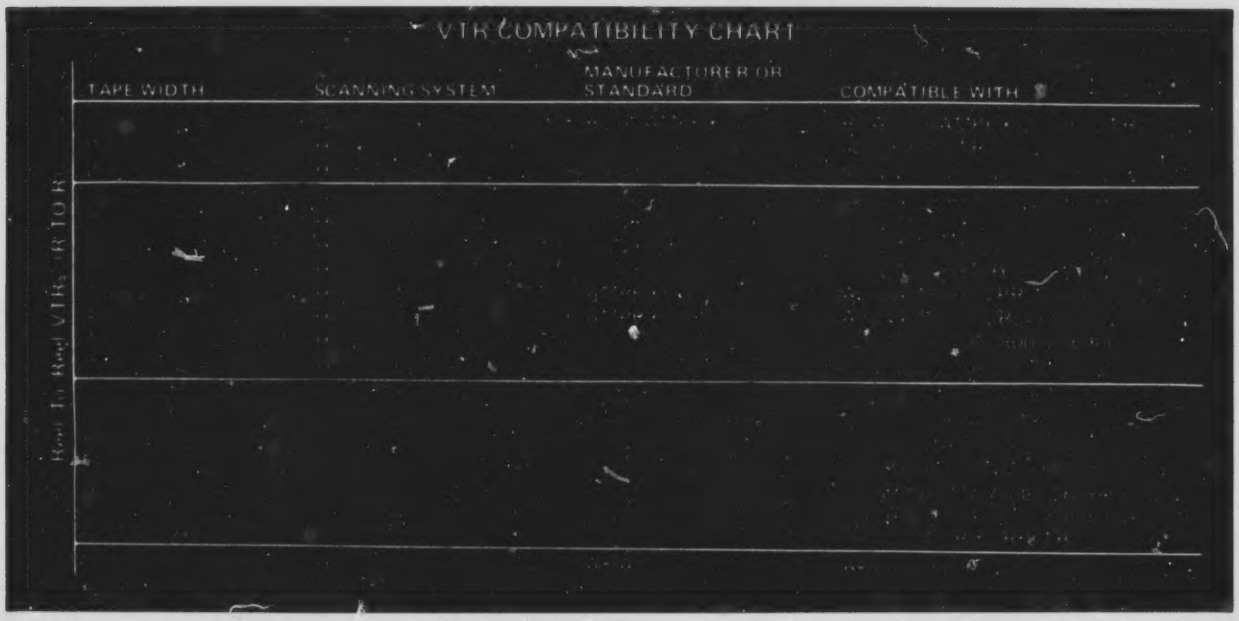
The problem this creates is obvious. The compatibility of a tape made on a particular VTR should be considered *before* making the tape. Consider how much difficulty others will have when they try to play back the programs you make on your particular VTR. If they are not on the same format as you are, find out how expensive and difficult it will be to transfer your tape to the appropriate format. *See Chapter 15—The Big Decision.*

Each VTR is known by the size tape it uses. There are 5 different tape sizes:

2-inch, 1-inch, ¾-inch, ½-inch and ¼-inch

There are many different VTR formats within the various tape sizes. As we mentioned earlier, a 2-inch VTR is considered large-format whereas the term small-format refers to the 1-inch, ¾-inch, ½-inch and ¼-inch VTR sizes.

Another VTR category is TAPE CONFIGURATION which refers to packaging, such as *reel-to-reel* or *open reel, videocassette, videocartridge,* or *videodisc*. In order to avoid problems, it is essential to have some knowledge of the relative compatibility of the various VTR formats.



	TAPE WIDTH	SCANNING SYSTEM	MANUFACTURER OR STANDARD	COMPATIBLE WITH
Videocassette Systems	[illegible]	Helical Scan	U-MATIC STANDARD	All U-Matic VCR's Sony, Panasonic, Quasar, JVC 3M, NEC, Telefunken and Wollensak U-Matic VCR's
	[illegible]	Helical Scan	SANYO V CORD II	Sanyo V Cord II [illegible]
	[illegible]	Helical Scan	AKAI	Akai [illegible] VT [illegible]
	[illegible]	Helical Scan	SONY BETAMAX	Sony [illegible] Betamax [illegible]
	[illegible]	Helical Scan	BETA 2 (°B) STANDARD	Sony, Sanyo, Zenith, Pioneer, Toshiba, Akai, Sears VCR only
	[illegible]	Helical Scan	VHS STANDARD	Panasonic, RCA, Magnavox, Sharp, Hitachi, Victor Co. of Japan, VHS [illegible] VCR [illegible]
	[illegible]	Helical Scan	PHILIPS	Philips [illegible] VCR [illegible]
Videocartridge Systems	TAPE WIDTH	SCANNING SYSTEM	MANUFACTURER OR STANDARD	COMPATIBLE WITH
	[illegible]	Helical Scan	EIAJ CARTRIDGE	All EIAJ Cartridge VCR [illegible]

VTR Standardization

Five serious attempts have been made to standardize VTR formats:

1. *The 2-inch quad format* had to be standardized so tapes could be interchanged among Broadcast TV stations.

2. *The 1-inch broadcast helical scan format* was agreed to by Sony and Ampex in 1977 and called the TYPE C HELICAL SCAN VIDEO RECORDING format and is a compromise between the Ampex VPR and Sony BVH recording systems.

3. *The ¾-inch videocassette format* (U-Matic) was standardized from the start by Sony.

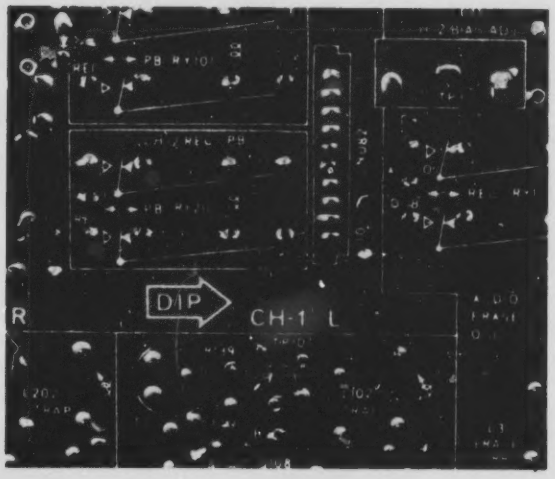
4. The very widely used *½-inch EIAJ reel-to-reel format* was established by the Electronics Industries Association of Japan in 1969. Unfortunately, several different ½-inch formats existed prior to the establishment of the EIAJ standard, but fortunately they have now become quite rare.

5. *The ½-inch Beta 1 and 2-hour and VHS 2 and 4-hour home videocassette formats.* These are 2 incompatible formats, but within each format there are many compatible machines produced by various manufacturers.

Unfortunately, manufacturers resist standardization because they feel it binds them longer to obsolete technology, but more standardization would sure make life easier for the video user.

Veteran video users have painfully accepted the fact that the manufacturers will always be changing formats on them without warning. The task then becomes how to use each format to its best advantage. There is no question that a variety of formats allows greater system flexibility and speeds technological advancements. New formats can be designed from the bottom up without having to conform to existing limitations.

Since all VTRs are electronically compatible, any videotape format can be copied to another format simply by plugging the 2 appropriate VTRs together and re-recording the program. In this manner, any tape can easily be transferred to whatever format is most expedient and economical for the user.



MAJOR VTR FORMATS

2-INCH REEL-TO-REEL VTRs

Ampex AVR-3 (2-Inch Quad)

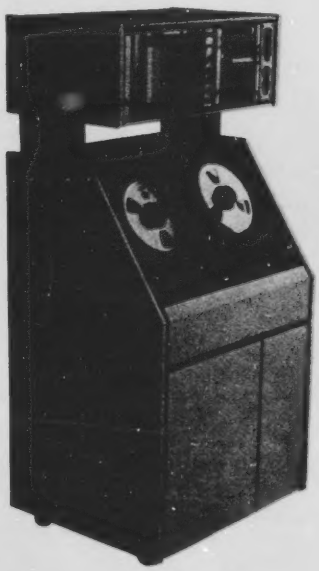
Super-good, outrageously expensive, and mammoth in size, a quad VTR generally is considered the best video recording and playback machine money can buy. An Ampex AVR-3 will run about $250,000 for a fully-loaded, signal-processed and image-enhanced machine. The quad's big advantage is its ability to go many generations (make copies of copies), perhaps 10 or 15, without significant quality loss.

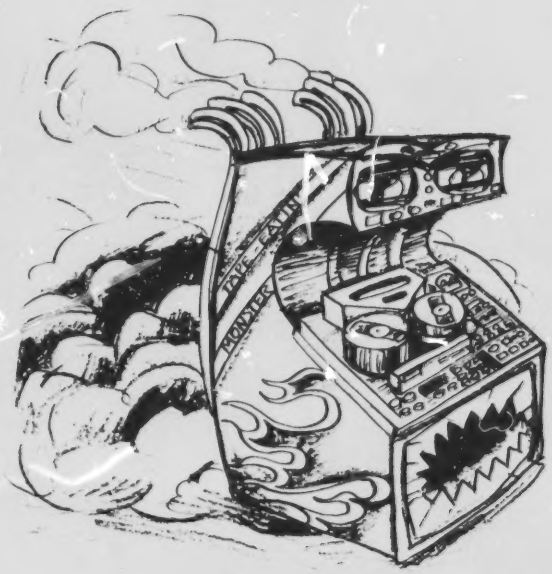
However, ultra-sophisticated 1-inch and 2-inch helical scan systems are moving in fast for the kill. The quad is now a very endangered species. The TV networks are the major users of quads and will convert to 1-inch helical scan for most or all of their production and playback purposes in the near future because the quality of 1-inch helical scan is nearly comparable to quad for a fraction of the price.

IVC-9000 (2-Inch Helical Scan)

The IVC-9000 is a unique 2-inch helical scan VTR system that features quad-comparable performance with only half the tape consumption. Simpler than a quad but still much more expensive than 1-inch, the IVC-9000 offers a wide range of excellent and very sophisticated production and editing features. *See Chapter 5—The VTR (IVC-9000).*

Ampex VPR-1





1-INCH HELICAL SCAN—REEL-TO-REEL VTRs

Ampex VPR-1 (Video Production Recorder)

The latest generation of sophisticated 1-inch VTRs, the VPR-1 is a high-performance high-band video recorder that can be purchased in a basic unit or upgraded to an entire system. The VPR-1 system includes AUTOMATIC SCAN TRACKING (AST), one-fifth speed broadcast slow motion, perfect still frame, manual jogging (movement of the VTR one frame at a time), real-time video verification (ability to monitor playback while recording), time base correction and more.

The VPR-1 sells for $20,000 to $60,000 and would be an excellent high-quality master production/editing VTR for a large industrial/educational TV system or for commercial broadcasting. It is compatible with other VPR-1 VTRs and also with the unique portable version, the VPR-20. Older Ampex VPR recorders can be retrofitted to the Type C broadcast format, and the newer machines that conform to the type C standard are designated VPR-2.

Ampex VPR-20

1-Inch Helican Scan VTRs

IVC 1-Inch Systems

IVC has developed an excellent reputation for 1-inch VTRs over a period of many years, and because of the flexibility and dependability of the IVC system, it has since become the world s most widely used 1-inch format.

All IVC 1-inch VTRs have a 5.0 MHz bandwidth with 400 lines monochrome (b&w), and 300 lines color resolution. The ½-inch and ¾-inch formats are limited to about 2.5 MHz and 250 lines in color. There are over 15,000 IVC-format video recorders in the field, and although the Company has developed several series of 1-inch VTRs over the years—the IVC-700, 800 and 900 series—it has made them all interchangeable.

IVC-761P

IVC-871P

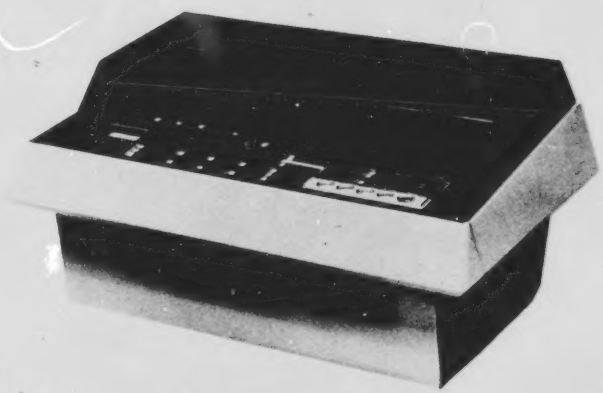
IVC-961P

IVC 1-Inch VTRs

Recently, IVC has introduced a new generation of 1-inch VTRs, the IVC-1070 ChromaCon 10, which features:

- High quality performance that "subjectively" equals quad high-band VTRs.
- The ability to produce a 5th generation tape copy that is clean, clear and crisp.
- Two professional quality audio channels, high reliability VTR design and simplified machine operation.
- An INSTANT VIDEO CONFIDENCE capability which allows monitoring the tape while recording and an improved motor drive and tape handling system.

Adaptors are available to convert other IVC series VTRs to record and play back ChromaCon 10 tapes.

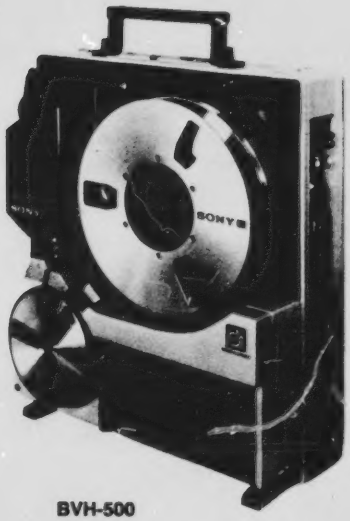


IVC-1070
Chromacon 10

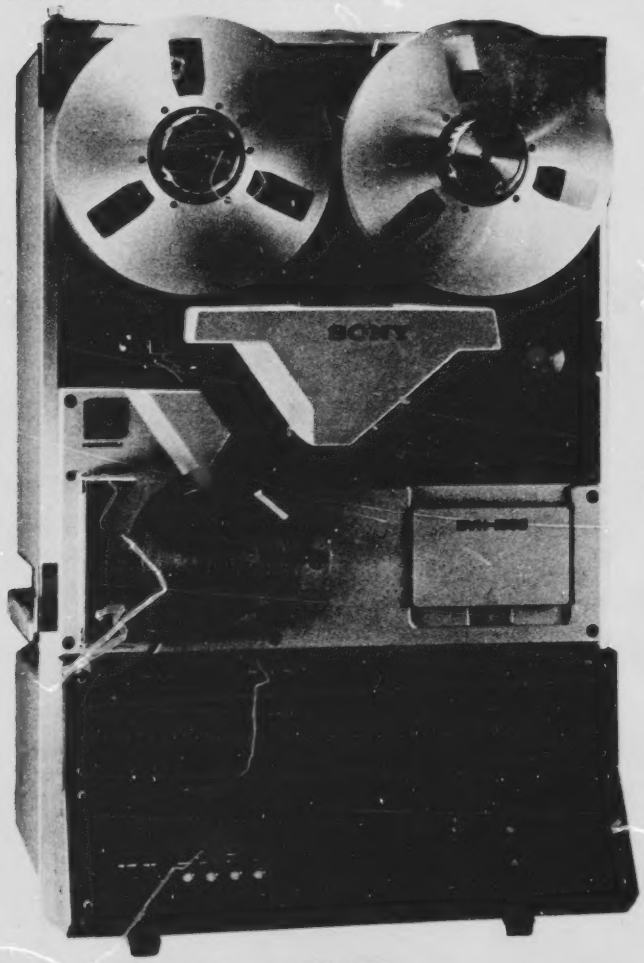
Sony 1-Inch BVH-1000 and BVH-500

Sony Corporation is the worst offender in proliferation of VTR formats. So far, there have been 3 different Sony 1-inch formats alone; the older EV SERIES, the short-lived UV SERIES, and the more recent BVH broadcast 1-inch VTR format. However, all of these earlier machines have been dependable and have offered many useful features that the IVC and Ampex machines ignored at the time. For reliability, Sony models far exceeded all other 1-inch VTRs regardless of price. Yet, the EV and UV series VTRs did not have the high-quality performance of better Ampex and IVC 1-inch VTRs.

Sony's BVH-1000 studio VTR and BVH-500 portable VTR (record only) are true high-band models designed specifically for broadcast applications. Older BVH recorders can be updated to the Type C standard broadcast 1-inch format, and newer machines are standardized.

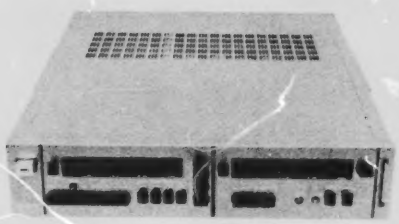


BVH-500

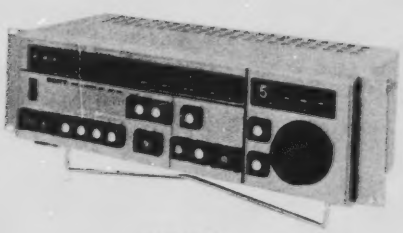


BVH-1000

SONY 1-INCH BROADCAST VTRS



BVG-1000



BVR-1000

The BVH-1000 Studio VTR features:

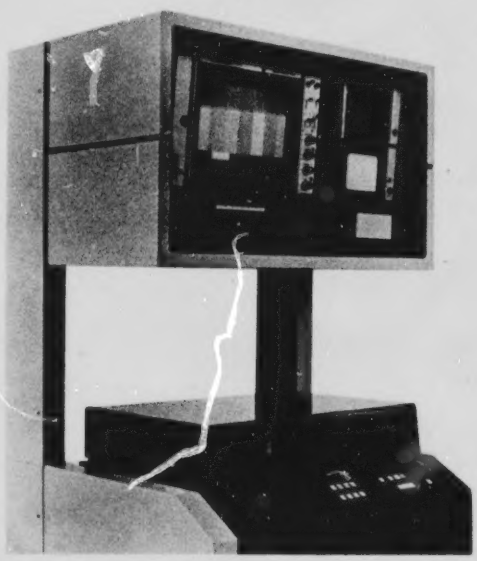
- A bandwidth of 4.2 MHz and a video signal-to-noise ratio of 48 db.
- A built-in bidirectional (BIDIREX) tape search control that allows the tape to be reviewed in forward or reverse like a film editing table. In the shuttle mode, the tape can be moved in either direction with coherent picture information from still and normal speed to over 60 times normal speed. This allows fast editing decisions to be made.
- Total editing control of 3 high quality audio tracks, including a CUE Channel which accepts SMPTE (tape address code) time-code information without internal modification. All tracks can be edited individually or simultaneously.
- 5 direct-coupled separate servo-motors and an advanced tape handling system.
- 2 concurrent digital tape timers perform a variety of record keeping and timing data.
- Easy to operate controls and advanced circuitry makes sophisticated adjustments easy for non-technical persons
- Modular design—VTR breaks down into 4 different components—tape transport section, operating control panel, electronics package and power supply. All 4 sections can be mounted separately.
- Interfaces with the Sony BVT-1000 digital time base corrector, BVR-1000 remote control unit and BVG-1000 VITC (Vertical Interval Time Code generator/reader).

The BVH-1000 studio VTR is truly state-of-the-art video technology in a compact, reliable and sensible package.

Other 1-Inch VTR Formats

To further confuse the issue, several other companies offer noncompatible 1-inch VTRs. These include Bosch-Fernseh with its BCN SYSTEM, a USA version of which is marketed by IVC and called the IVC-8000 series. The BCN is a very reliable VTR and produces a quad comparable picture image. The IVC-8000 series includes the IVC-8020, one of the few portable (44 lbs.) broadcast VTRs; the IVC-8040, a compact unit designed for mobile van use; and the modular designed IVC-8050 studio VTR.

IVC-8050



BCN Modular System

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¾-INCH U-MATIC VIDEOCASSETTE

Sony, Panasonic, Concord, JVC, Wollensac, NEC, Telemation, Teac and others all market compatible ¾-inch videocassette units.

JVC CR-8300U

The U-Matic videocassette recorder (VCR) uses ¾-inch Chromium Dioxide videotape in a 2-reel enclosed cassette, several times larger than the standard audiocassette. Advantages of the videocassette are: ease of handling, no threading, longer life, fewer dropouts, and stereo sound. All U-Matic videocassette machines can play either b&w or color and have 2 sound tracks for stereo.

The standardized ¾-inch videocassette is known as the U-MATIC FORMAT. Sophisticated U-Matics are used by all major broadcasters and various models are found in most TV production studios. All ¾-inch U-Matic videocassettes are interchangeable regardless of size and manufacturer.

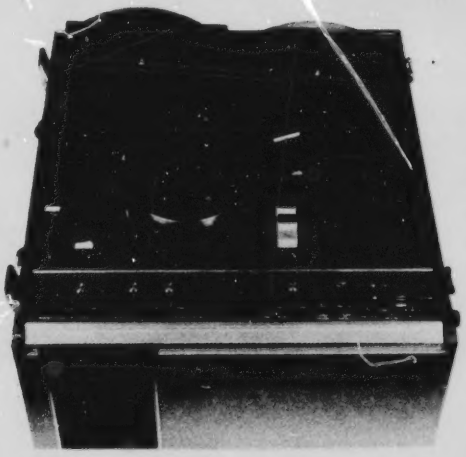
A vast range of ¾-inch VCRs are available ranging from basic portable player-only machines to extremely sophisticated editing units with remote control and automatic editing control systems. A U-Matic VCR can be used for just about any application including broadcasting if used with the appropriate time base corrector.

½-INCH VIDEO FORMATS

½-Inch EIAJ—Reel-to-Reel VTRs

½-inch EIAJ reel-to-reel, "the old trailblazer," will live on as the format that really brought television into the hands of the people. More than any other piece of hardware, the ½-inch VTR *is video*. ½-inch made video possible economically for the visionary masses.

Sony Portapak
AV-3400/AVC-3450



Panasonic NV-3160

A wide range of compatible VTRs is available in b&w, and color, portable, and studio configurations. The ½-inch format is the least expensive total production/editing video system.

The ½-Inch Videocartridge

The ½-inch videocartridge differs from the ¾-inch videocassette in that the cartridge contains only *one* reel of tape, uses ½-inch tape instead of ¾-inch tape, and has only one sound track—no stereo potential as with the ¾-inch cassette.

Panasonic "Omnivision"

The significant advantage of the videocartridge is its ability to accept physically any 20- to 30-minute ½-inch EIAJ videotape. The tape must be wound onto a special self-threading cartridge reel and requires a plastic leader and a special cartridge playback VTR, but this means that any ½-inch EIAJ tape, b&w or color, can also be used in a cartridge format.

This system combines the advantages of the VCR—such as easy threading, less wear on the tape, and ease of playback—with the already existing flexible system of ½-inch EIAJ reel-to-reel VTRs. Although now discontinued, cartridge units originally were slightly less expensive than ¾-inch videocassette systems.

However, the cartridge systems, manufactured only by Panasonic and Hitachi, are limited to 30 minutes of record and playback time, whereas the ¾-inch systems will record and play up to 60 minutes with standard tape and 90 minutes with extended-play tapes. Because of the U-Matic, the ½-inch cartridge never really got off the ground and has quietly been discontinued.

½-Inch Videocassette Systems

By 1976, video technology had evolved to the point where it could make a serious bid for the home. The ½-inch videocassette format was specifically intended for this purpose. Unfortunately, history seems to have repeated itself, because, as with ½-inch reel-to-reel, several odd ½-inch videocassette formats have inundated the marketplace before any standardization took place.

Most ½-inch videocassette recording systems share the same basic features:

- Easy connection to the VHF terminals of any standard TV set
- Easy cassette loading
- Built-in TV tuner, which allows you to watch one program on the TV set while the VCR is recording on another channel
- Accessory digital timers for automatic recording of TV programs
- Pause control to stop tape playback or eliminate commercials
- Inputs for external b&w or color video cameras and microphones
- Audio dub control to add sound to previously recorded tape
- Instant replay and immediate playback of taped programs
- Built-in memory for returning to a specific point on the tape
- Extended recording and playback times—
  - Sanyo V-Cord II format—1 or 2 hours
  - Beta format—1 and 2 hours
  - VHS format—2 and 4 hours

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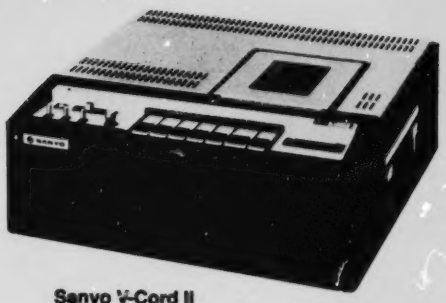
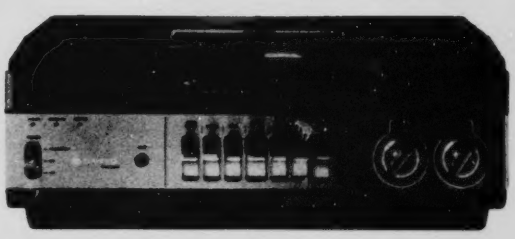
Sanyo V-Cord II VCR

The Sanyo V-Cord II is a ½-inch videocassette system that incorporates 2 recording modes—a standard play mode of 1-hour and an LP mode of 2 hours. Like the Sony Betamax, the Sanyo achieves the long recording time by moving the tape very slowly past the videoheads—at 2.91 ips in the standard mode and 1.45 ips in the LP mode. The LP mode uses a SKIP FIELD recording process in the LP mode which means that every other scanned field is recorded and played back twice instead of recording 2 different fields and interlacing them. The result is a slight difference in picture quality relative to the standard mode. A variety of models are available in the V-Cord II format, which is unique to Sanyo.

Sanyo also produces its own 2-hour Beta format ½-inch VCR called the BETACORD which includes among other useful features, good picture and sound quality, simple one-finger operation, a remote pause control (VTC-9104A models only) and an automatic-off "sleep" switch for taping late night movies.



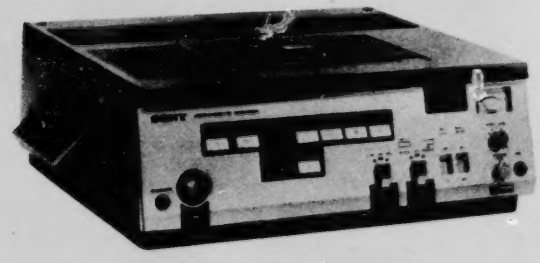
Sanyo V-Cord II
VTC-8400



Sanyo Betacord VTC-9103/9104A

Sony ½-Inch VCRs

There are now 3 different Sony ½-inch VCR formats, the X1, X2, and X3 modes. The Sony industrial VCRs are all X1 or 1-hour only whereas the Sony home VCRs are generally X2 only or X2 and X3. The first Sony home VCRs were X1 only, but some play and record in both the X1 and X2 modes. The newest Sony Beta home VCRs such as the SL-5400 and SL-5600 feature playback in all 3 formats. Also, a rapid scan feature called BETASCAN has been added. A newer series of industrial Betamax VCRs now have dual sound tracks for stereo and several very sophisticated optional random access programmers. *See page 148.*



Sony SLO-320

Betamax
Cassette

Sony SL-5400

Sony Betamax VCRs

The portable SLO-340 VCR weighs only 20 pounds including the battery, and will operate for 45 minutes with the DXC-1610 color camera on one internal BP-60 battery. The unit will accept either the AVC-3450 b&w camera or the DXC-1610 color camera, will playback through any standard TV set in b&w or color, gives instant replay through the camera viewfinder, and records on a 60 minute Betamax cassette. A b&w package will cost about $2,000 and a color package under $5,000.

Betamax SLO-340/DXC-1610

Beta 2-Hour Home Videocassette Recording System

Sony also has available a home color portable Beta-2 system. Similar to the SLO-340 in design, the SL-3000 records in the 2-hour (X2) mode but can playback in both the 1-hour (X1 and X2) modes. An optional timer, tuner and RF adaptor are available for recording and playback with conventional TV receivers.

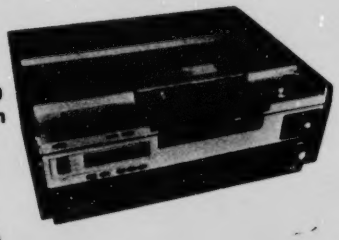
The portable color camera uses a 2/3-inch Trinicon tube and features a built-in automatic iris zoom lens and optical single lens reflex viewing system. The lens is a special design, not a C-mount, is only a 3:1 zoom, and the optical viewfinder makes accurate focusing diffiucult as compared to an electronic viewfinder type camera. The camera's low light ability and picture quality is not as good as some of the other low-cost home color cameras such as the JVC G-Series cameras. The VCR weighs 19 lbs. with tape and battery pack, but lacks all the nice input and output connectors that the JVC HR-4100 has. The camera weighs only 4lbs. 14 oz.

The Beta 2-hour (X2) format is basically an extended version of the Sony 60 minute Betamax system. Earlier Beta models had a 1 or 2-hour switch which in the 1-hour mode, allowed it to play back tapes recorded on the industrial Betamax VCRs. However, the 2-hour only Beta systems cannot play back tapes made on the 1-hour Betamax systems which effectively separates the 1-hour and 2-hour mode only Beta VCRs into two different incompatible formats. This is a big disadvantage for the Betamax/Beta format.

Sony SL-3000 Beta-2 Portable Home Video System

The Beta 2 VCR uses the same size cassette as the Betamax 1-hour system, but by halving the tape speed to a slow creep of 0.785 ips and reducing the track width proportionately, double playing time is achieved. Additional circuitry enables the system to achieve 240 lines color resolution and a remarkable 45 db signal-to-noise with the SL-8600. The SL-8600 also features a remote pause control and a front mounted digital LED timer.

The Beta 2 system is intended primarily for home off-the-air recording, home recording with a camera and microphone and playback of mass marketed pre-recorded tapes. Fotomat Corporation will convert 8mm and super 8 home movies to Beta format cassettes for about $3 per roll of 50 ft. film. They will also transfer 35mm and Instamatic slides to tape and add a fast lap dissolve between slides. Other companies such as S/T Videocassette Corp., 500 Willow Tree Rd., Leonia, N.J. 07605 (Family Vision) offer similar services



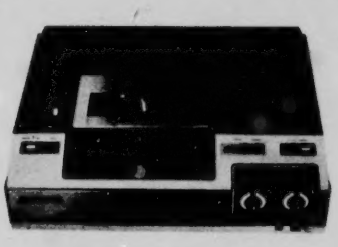
Sony SL-8600
Beta-2 System

The VHS Format

Polishing up their own electronic armour is an equally imposing array of video and TV chieftans committed to the VHS (Video Home System) format developed by the monolithic Matsushita Electric Company LTD of Japan (Panasonic). American heavies, RCA and Magnavox, have joined ranks with Matsushita, along with the Victor Corporation of Japan, Sharp and Hitachi. The VHS system's big advantage is an astounding 4-hour recording and playback capability.

The VHS machine is compatible with the JVC ½-inch videocassette in the 2-hour mode only. The 4-hour time has been achieved by further halving the tape speed and narrowing the recording track. Noise reduction circuitry also has been added.

The battle of the giants is again underway over the market for ½-inch video systems. On one side of the great home video battlefield we find the powerful coalition of Sony, Toshiba, Sanyo, Zenith and Sears, all of which offer a basic Beta format home VCR system. Older Sony and Zenith units had a 2-speed capability, 1-hour and 2-hour modes, but the newer designs offer a 2-hour mode *only*. In the 2-hour mode, all tapes made on Beta 2-hour systems are interchangeable. Most Beta systems will accept a wide variety of microphones, b&w and color cameras and other accessories. Suggested retail prices are around $1,000.



Panasonic "Omnivision IV"
VHS System

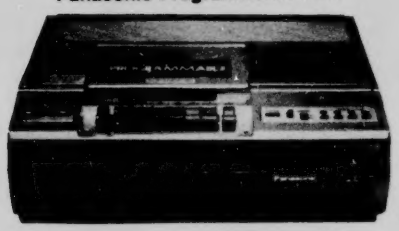
The VHS system provides an extremely wide range of choice between manufacturers features and accessories. VHS systems, unlike earlier Beta systems, offer integrated digital LED timers, remote pause controls, an audio dub feature and rigid die-cast chassis construction. All VHS systems except the JVC Vidstar and MGA VCRs

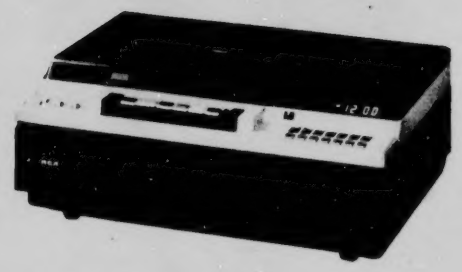
are capable of recording and playing back in both a 2-hour and 4-hour mode. Tapes made on VHS systems are *not* interchangeable with any Beta units and vice versa. There is some loss of picture and sound quality in the "slow" or 4-hour mode, but the quality is quite adequate for off-the-air recordings. The 4-hour recording time is almost a must when used in conjunction with the programmable VCRs.

Programmable VCRs

There are at least 14 distributers of VHS home ½-inch systems. RCA, Magnavox and Panasonic have unique programmable VHS VCRs which feature push-button channel selection and an automatic digital clock and control center that allows the user to preset the VCR to record up to 4 different programs up to a week in advance. The VCR will automatically turn on, select the channel, start and stop the recording for a specified period of time—four times. An electronic indexing system makes it possible to quickly locate each program that was recorded on either a 2-hour or 4-hour cassette. Tapes made on these programmable units are interchangeable with any other VHS system in the same-speed mode. Prices for these systems are around $1,300.

Panasonic Programmable VCR



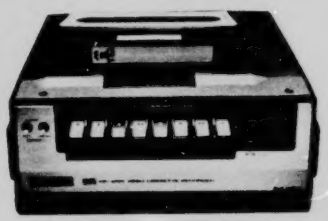


RCA VCT-400 Programmable VHS VCR

Portable VHS Systems

JVC who pioneered the basic VHS format also was the first to introduce a truly practical color home portable video system JVC calls its ½-inch VCR systems VIDSTARS. The HR-4100 JVC VHS portable weighs only 21 lbs. and is a completely self-contained rechargeable battery operated portable video recorder. The VCR will operate for 3 hours with the JVC G-series color cameras although the tape cassette is limited to 2 hours. The VCR will play back instant color pictures and sound on any TV set, and the system includes an AC adaptor which also charges the batteries. The HR-4100 VCR utilizes a capstan servo for precise tape transport, and its gyroscopic internal head design allows it to be swung around without mechanical damage or recording malfunction. Built-in pilot lights indicate battery charge level, problematic moisture conditions or a misloaded cassette.

The portable JVC system is truly a major technological and price breakthrough, not just for home video users, but for all avid videophiles who have been waiting for a reliable, low-cost, light-weight, compact, self-contained portable color video system. Many new applications and much wider use of video should now result from such systems. The tapes made on the portable Vidstar can be played on any VHS system, and most cameras and microphones can be used with the JVC recorder.



JVC HR-4100 Portable VHS

JVC G-71US

Other VHS system features

JVC also has Vidstar VHS VCRs which perform some unusual tasks. The HR-3600 is very lightweight and energy efficient, and it features three specialized playback modes and also remote control capability.

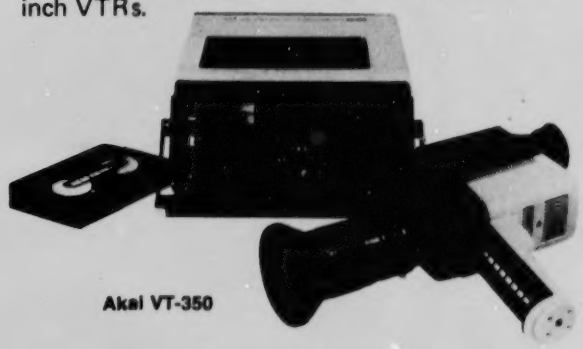
The HR-3600 is able to play back tapes in real-time and also provide stop action, a fair quality slow motion and double-speed playback as well. In the double-speed playback mode, the video portion is reproduced with a visible picture, and the "squeaky voice" effect is eliminated through use of digital voice compression technology. Thus, a 2-hour taped program can be viewed in1-hour. The double-speed mode also allows easy fast access to any segment of the tape.

JVC HR-3600

NOTE: Tape manufacturers caution against using the tapes intended for 2-hour only VCRs on any of the other VHS machines in the 4-hour recording and playback modes.

Akai ¼-Inch and ½-Inch Video Systems

Akai Corporation for many years has pioneered the only ¼-inch reel-to-reel system on the market. The ¼-inch format never became really popular due to the superior quality and flexibility of ½-inch VTRs.



Akai VT-350

In 1977, Akai introduced the VT-300, a sensible modular ½-inch b&w videocassette portable system which was soon followed by the VT-350, the first portable vertical interval editing unit. The speed of the VT-350 can be continuously varied during playback, and the editing feature achieves perfectly "clean" edits by backspacing the tape automatically. Extremely lightweight and compact, the VT-300 and VT-350 systems offer an economical and easy way to shoot b&w tape on location. However, these systems are not Betamax or VHS compatible but rather are a special Akai format. Prices range from $1,500 to $2,150 depending on the specific package.

How to Insure Maximum Compatibility

U-Matic ¾-inch videotape interchangeability is superior to the ½-inch EIAJ reel-to-reel format. Because the ¾-inch tape is in cassette form and threaded automatically, human hands and sticky fingers are eliminated. This helps greatly. In addition, the actual mechanics and electronics of the ¾-inch VCR design represents a vast improvement over the ½-inch EIAJ VTR. Incredibly, Sony forgot to include skew controls on its early non-editing U-Matic Type II VCR models. This is a serious oversight as skew variations in tapes made on other videocassette machines cannot be corrected. This is not usually a problem when simply playing back the tapes for viewing, but it is a concern when making dubs or editing. Newer models such as the VO-2610, VO-2611 and VP-2260 have skew controls.

Insuring videotape interchangeability is a difficult and precise business which requires strict manufacturing standards. These standards often are not perfectly adhered to by the manufacturers, and there are subtle differences between individual VTRs which hinder true tape interchangeability. These differences include such factors as variations in tape tension (skew) between different manufacturer's VTRs and head drum surface coatings that affect tape playback. Of course, any improper variation in tape path or head alignment on a VTR will seriously hinder tape interchangeability. Heavy VTR users who require that their machines work at optimum levels should check the tape alignment (tracking) and tension (skew) routinely with a factory standard tape (available from the VTR manufacturer) and a tension gauge (available from Tentel Corp), *see Chapter 14—Maintenance.*

Home ½-inch VCRs do not require so much attention and alignment, especially the Beta systems, but all VCRs will need an occasional general check up and replacement of some mechanical parts every 1200 or 1500 hours of use. This can be expensive ($100-$400), so investigate an extended warranty program, available from most home VCR dealers.

Typical Videotape Format Sizes

Overview

As you can see, there is a wide range of VTR formats to fill all your needs, provided you have the dollars. If just starting in video, you can select whatever format is best suited to your level of technical competence and programming needs. If you've inherited a conglomeration of incompatible VTRs, first try to define which VTRs are best for recording, which ones can be used for dubbing, and which ones will become boat anchors or decorative rock garden pieces.

Once you have taken the inventory of salvageable equipment and issued the obituaries for those older VTRs that must make *The Great Video Transition,* you then can go out and spend your money on sparkling exotic new video technology.

Think Before You Spend

Older VTRs are "free" but they may not do the job well enough and that may cost you money. New video technology may represent a considerable capital risk. Think out any sizable investment in video equipment *carefully.* Do you really need 2 sophisticated editing VCRs when you could get by with one new editor and use one of your present videocassette units as a playback machine? Could you make do with some of your other equipment for most of your present applications and just rent the high-priced gear when you need it for a big job with a big budget?

Remember, too, that videotape can be copied from other formats and time base corrected, image-enhanced and noise-reduced. Now, image processing technology is at the point where tapes can have their total picture quality substantially improved by certain processing techniques. Of course, this can be expensive. Without sophisticated processing technologies, some quality loss will result and transfers may incur additional costs and present extra problems.

These are questions that deserve research on your part when you contemplate purchasing video equipment. For more thoughts on the matter, *see Chapter 15—The Big Decision.*

Having surveyed the variety of specific VTR formats, we will now get our "hands on" some basic VTR equipment.

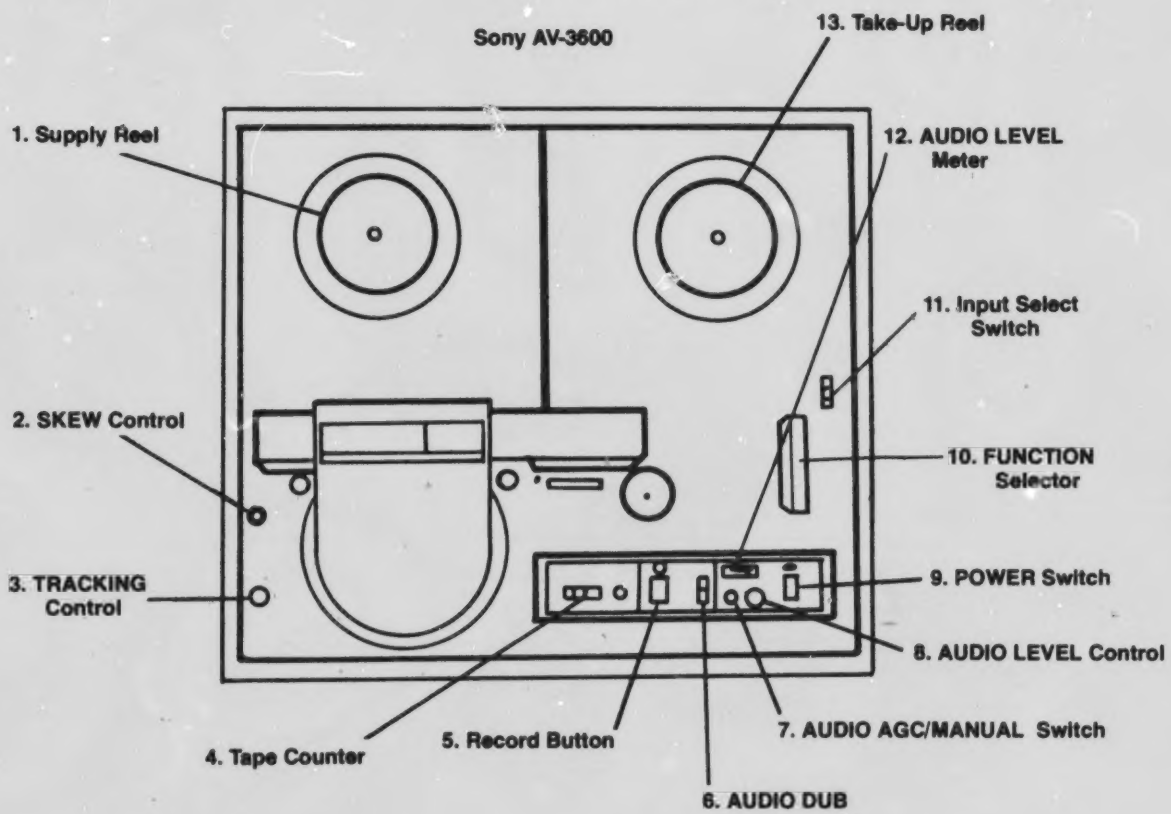
Up to this point we have examined the wide variety of available video equipment and how it might be commonly used.

Next, we will treat the specific features and operational procedures of the most commonly used VTRs and VCRs.

Chapter 10
Connecting And Operating The VTR

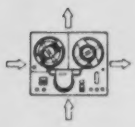
As a preliminary to the actual "hands on" operation of the equipment, it helps to have an understanding of the various component parts of the standard VTR.

A very popular basic ½-inch VTR is the b&w EIAJ Sony AV-3600. The controls and operational functions on this unit are similar to all the other Sony ½-inch reel-to-reel VTRs.



Controls and Connectors—Sony AV-3600

1. SUPPLY REEL SPINDLE—Place a full reel of tape here.
2. *SKEW* CONTROL—This control operates in *playback* mode only. It adjusts the tension of the videotape around the video head drum. Adjust it if the images are bent at the top of the screen. Do not turn this control while recording. *See Skew Control Adjustments, page 124.*
3. *TRACKING* CONTROL—This control operates in playback mode only. It adjusts the tracking of the VTR to compensate for differences in tapes made on other VTRs. *See Tracking Control Adjustments, page 124.* Do not adjust while recording.

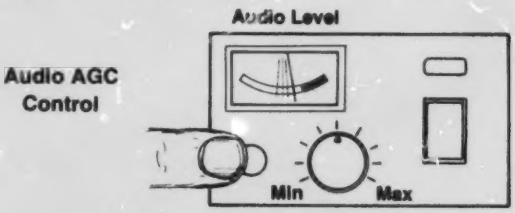


4. TAPE COUNTER AND *RESET* BUTTON—The tape counter indicates the amount of tape used. Push the reset button to 000 at the start of the tape. The counter is not particularly accurate.

5. *RECORD* BUTTON—This button will activate in RECORD, STOP or PAUSE modes only and will cause the VTR to record picture and sound. To begin recording, depress the RECORD button and move the function selector to FORWARD mode simultaneously—use two hands. To monitor the picture and sound, depress the RECORD button when the VTR is in the STOP mode.

6. *AUDIO DUB* BUTTON—The audio dub control operates in playback mode only and allows new sound to be added without erasing the picture.
NOTE: The old sound is erased when the new sound is added.

7. *AUDIO AGC/MANUAL* SWITCH—This control operates in playback mode only and allows automatic gain control (AGC) or manual control of the sound recording level. Depress the button to select manual control.



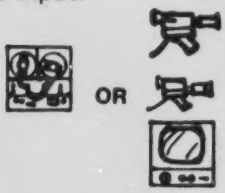
8. *AUDIO LEVEL* CONTROL—This control operates in the manual mode only. Adjust for the proper level on the audio level meter (No. 12).

9. *POWER* SWITCH—Turns the VTR ON or OFF.

10. *FUNCTION* SELECTOR—This selector is a 5-position switch that controls the function or mode of the VTR. It always should be kept in the STOP position unless the VTR is playing or recording. The five positions are:

FAST FORWARD	advances tape rapidly
PAUSE/STILL	stops tape for still picture
FORWARD	moves tape at normal speed for record or play
STOP	stops tape
REWIND	rewinds tape

11. INPUT SELECTOR SWITCH—This switch operates in record mode only and selects the appropriate input:



— CAMERA—selects 6-Pin camera input only
— LINE—selects VIDEO IN input (camera or VTR)
— TV—selects the 8-Pin input from a TV monitor—used for recording off-the-air programs

12. *AUDIO LEVEL* METER—This meter displays the audio level in record and playback modes. When recording the audio manually the needle should barely peak into the red zone on the loudest sounds.

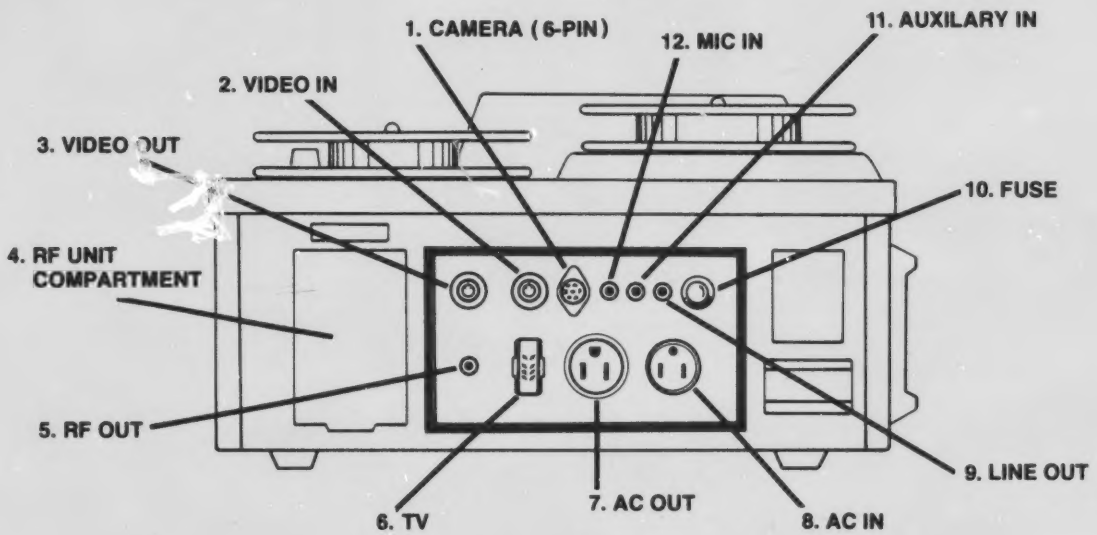
13. TAKE-UP REEL SPINDLE—Place an empty reel here.

Common Color VTR Controls (Color VTRs only—Sony AV-8600/AV-8650)

COLOR LOCK CONTROL—This control is found usually on the top of the VTR. Adjust with a small screwdriver if the VTR cannot maintain the correct color hues in the playback picture. The control should be kept in the DETENT (notched) position.

VIDEO *MODE* SELECTOR—Located on the top plate of the VTR, this control adjusts the VTR for either B&W or COLOR recording and playback.

Plugs And Connectors—Sony AV-3600

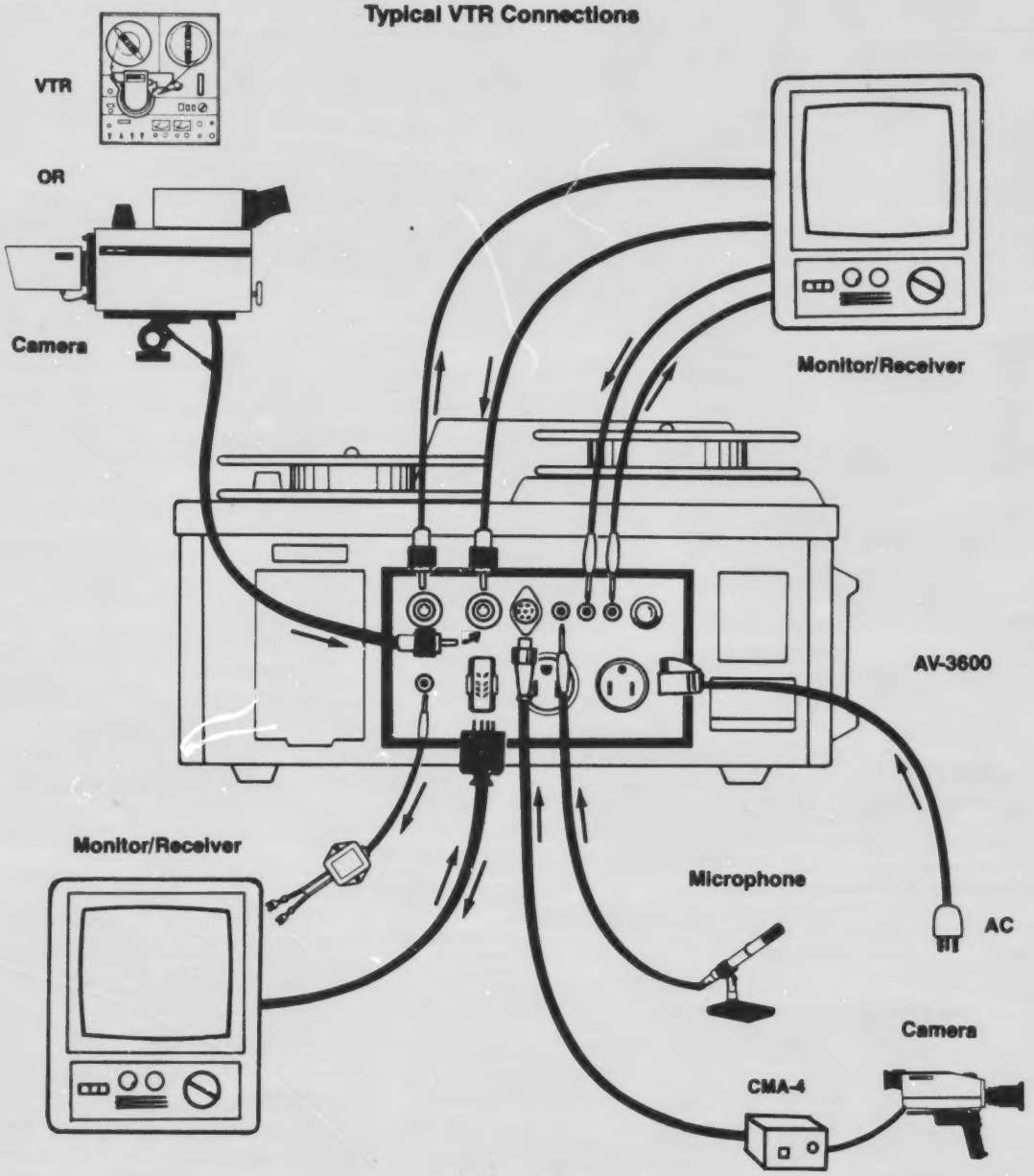


Plugs and Connectors—Sony AV-3600

1. *CAMERA*—Plug a 6-Pin cable in here from a Sony AVC Series camera.
2. *VIDEO IN*—Accepts a UHF-type cable from a camera, VTR, or monitor.
3. *VIDEO OUT*—Accepts a UHF-type cable. Connect to a monitor or a second VTR.
4. *RF* UNIT COMPARTMENT—Insert optional RF Adaptor here. Allows playback of picture and sound on a regular TV set.
5. *RF OUT*—Plug optional RF cable in here and connect to any TV set.
6. *TV 8-PIN CONNECTOR*—Use an 8-Pin cable to connect to any standard TV monitor. The 8-Pin carries sound and picture to and from the monitor.

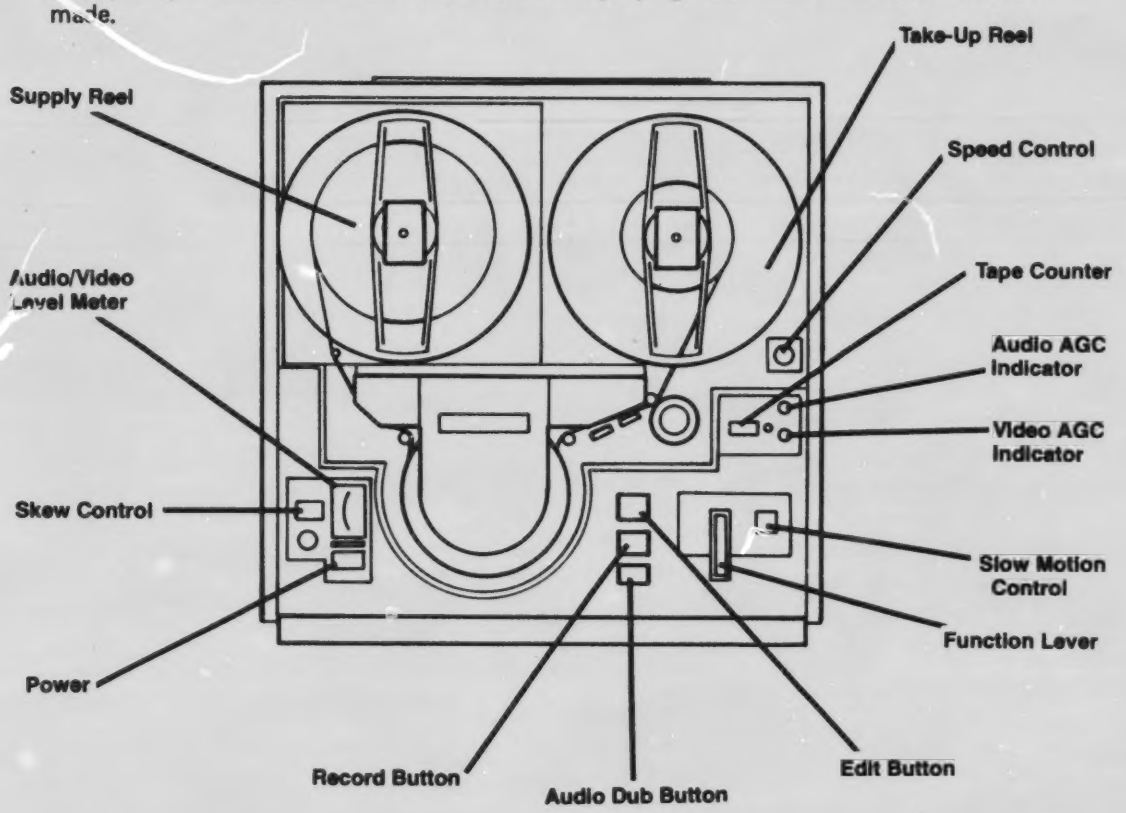
7. *AC OUT*–Supplies up to 500 watts AC power to another unit, such as a monitor or camera.
8. *AC IN*–AC power cord connects here from any 120-volt AC 60 Hz source.
9. *LINE OUT*–Connect to auxiliary sound amplification, a recording VTR or a TV monitor. This output is for sound use only.
10. *FUSE*–2 amps–Do not use a fuse with a higher rating.
11. *AUX*ILIARY *IN*–Accepts a sound input from a playback VTR, audiotape player, or microphone mixer. This input will *not* accept a microphone.
12. *MIC IN*–Connect a good quality low impedance microphone here.

Typical VTR Connections

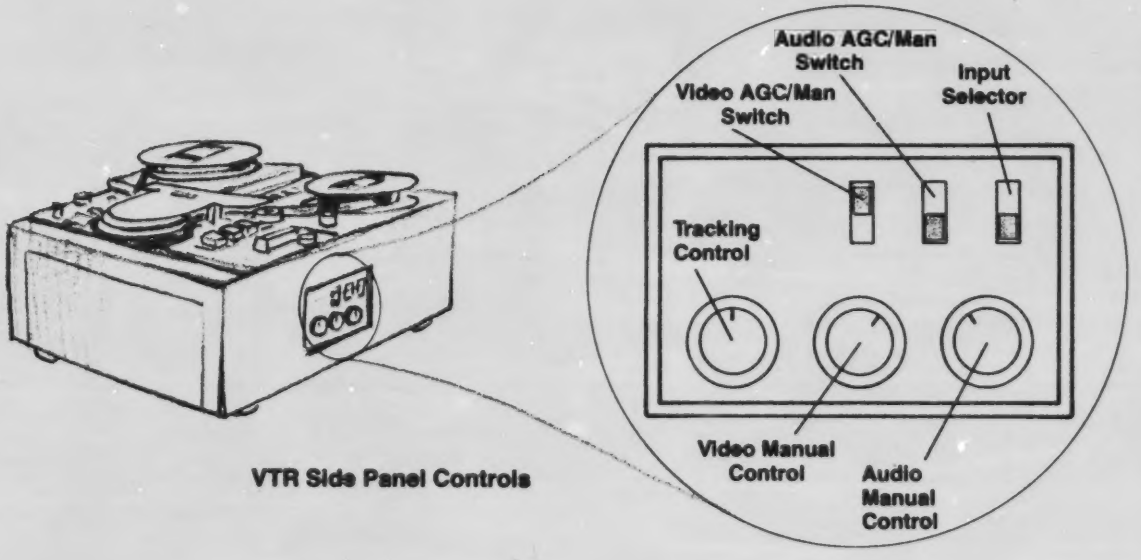


Panasonic NV-3020 SD

The Panasonic NV-3020 SD is a slightly different style b&w ½-inch EIAJ VTR. It offers more features than the Sony AV-3600 VTR. The NV-3020 SD incorporates a manual and AGC control of the video level, a fair quality slow motion mode, and the ability to go into record mode while the VTR is playing back. Thus a crude edit can be made.

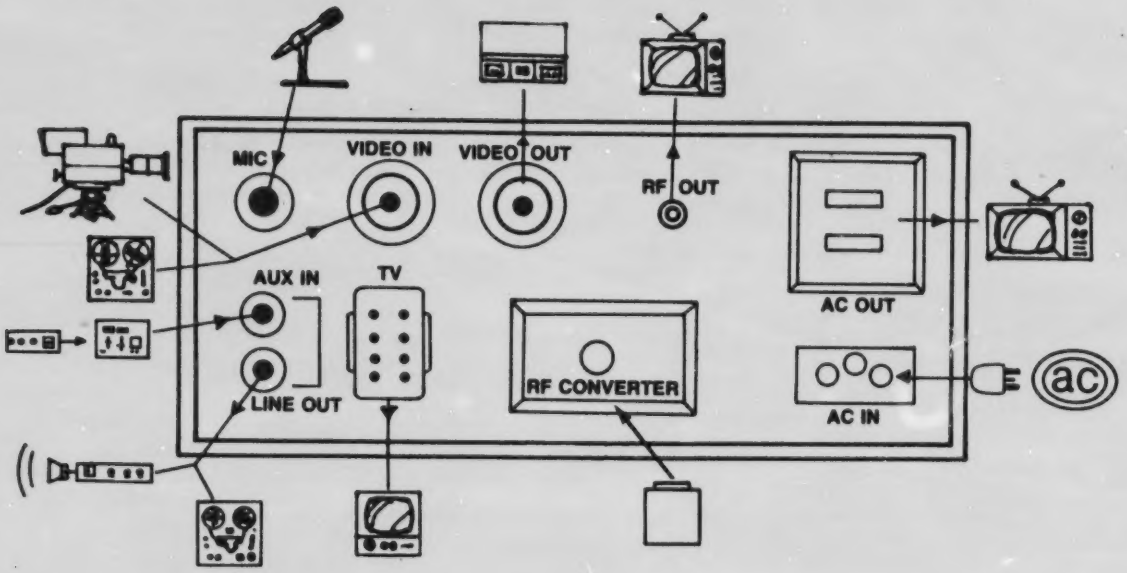


Panasonic NV-3020SD VTR



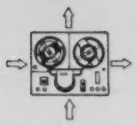
VTR Side Panel Controls

PANASONIC NV-3020 SD Rear Panel Connections



VTR Precautions

- The video rotary heads are delicate and brittle and will not withstand any impact with a solid object. Cleaning should be attempted only when the video heads are completely stopped.
- Operate the VTR only in a horizontal position.
- *DO NOT* block the ventilation grills on the bottom of the VTR or it may overheat.
- Keep VTR clean at all times and free from dust. Keep the machine covered when it is not being used.
- *AVOID* subjecting the VTR to mechanical shock or vibration.
- *DO NOT* allow cigarette smoking anywhere near VTRs or near room air currents that might pass the VTRs.
- *DO NOT* handle videotape or VTRs after smoking without first washing your hands.
- Make sure the FUNCTION SELECTOR LEVER is in the STOP mode when the VTR is not in use.
- Use the same size reels for supply and take-up reels.
- *DO NOT* operate the VTR in extreme temperatures.
- Clean the VTR head drum immediately if it is exposed to salt air.
- Have your VTR checked twice a year for proper tracking and skew specifications.



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OPERATING THE REEL-TO-REEL VTR

Videotape Threading Procedure

In order to record or play a tape on a reel-to-reel VTR, the videotape first must be properly threaded.

Procedure:

Step 1 Place a full reel of tape on the supply reel spindle (left side of the VTR).

Step 2 Place an empty reel on the take-up reel spindle (right side of the VTR). Make sure the take-up reel is the same size as the supply reel.

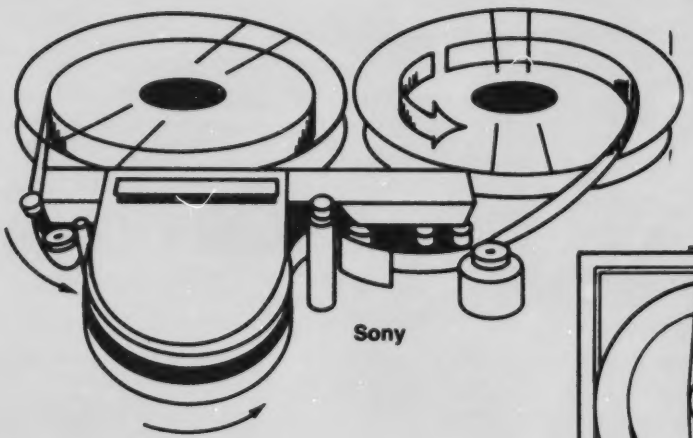
Step 3 Make sure the VTR is in the STOP MODE and that no whirring sound is coming from the video head assembly.

Step 4 Unwind about 2 or 3 feet of the tape from the supply reel.

Step 5 Thread the tape from left to right as illustrated:

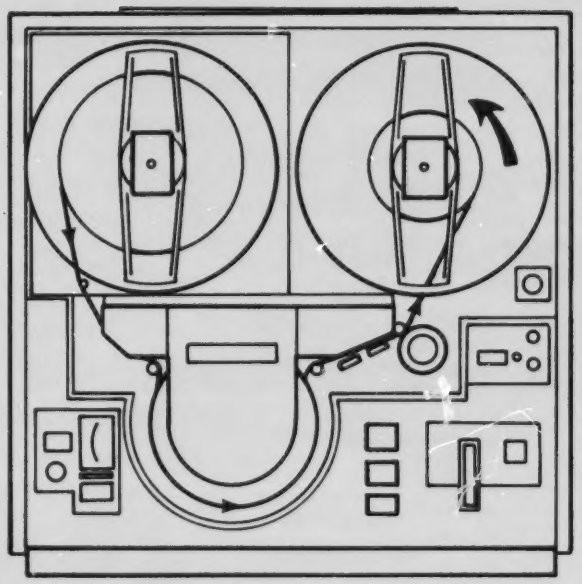
- The *dull* side of the tape should face the operator.
- The *shiny* side of the tape should face the video heads.

Threading Procedures

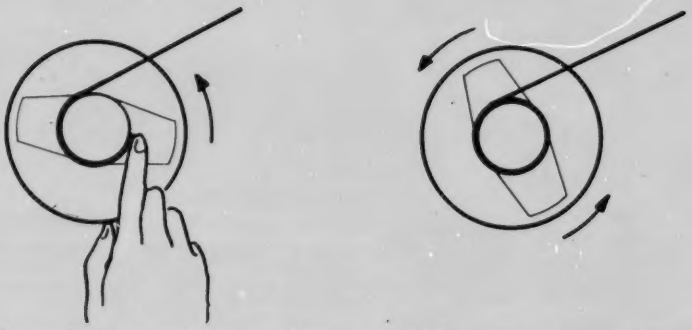


Sony

NOTE: Most VTRs have a threading diagram located inside the front cover for quick reference.



Panasonic



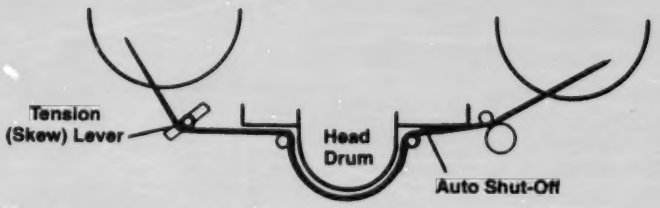
Step 6 Place a finger inside the take-up reel and hold the tape against the reel hub. Rotate the take-up reel one full turn counterclockwise until the tape slack is taken up and then remove your finger.

Step 7 Visually recheck the threading.

Step 8 Place the VTR in PLAY mode to confirm that the tape is seated on the take-up reel and threaded properly.

Tape Threading Precautions:

- *NEVER* thread the VTR while the video heads are slowing down, otherwise the heads may become damaged.
- Make sure the tape is in the guide path correctly and not caught on something, otherwise the tape will become creased and useless.
- Make sure no tape guides, rollers, or little levers have been missed when threading.
- Be sure to check the tension and automatic shut-off levers. If the tape is not threaded around the tension lever properly, the tape will not play back correctly. If the tape does not exert sufficient pressure against the automatic shut-off lever, the VTR will not operate.



- Always play the VTR for a few seconds to confirm that everything is working properly. *Always* make a test recording and play back the tape *before* beginning your program taping session. *Now* is the time to find out if anything is wrong.

Minor Troubleshooting

- If something does go wrong, the first thing to check is the threading. Don't hesitate to re-thread the tape.
- Remember, only the *shiny* side of the tape can be used for recording.
- If the tape gets caught and slips inside the video heads, stop the VTR immediately, gently pull the tape out, taking care not to crease it. If the tape is hopelessly snagged inside the head drum, carefully remove the head drum cover and cut the bad tape out with scissors and remove it from the VTR.

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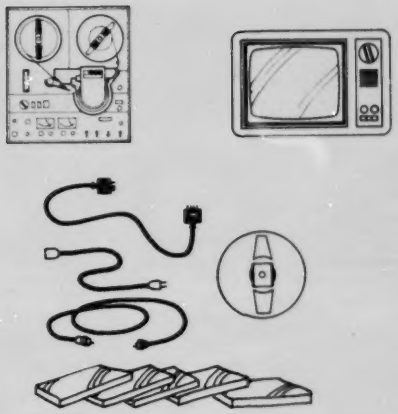
VTR Playback

Equipment Needed:
- 1 VTR
- 1 TV monitor/receiver or TV receiver with RF Adaptor

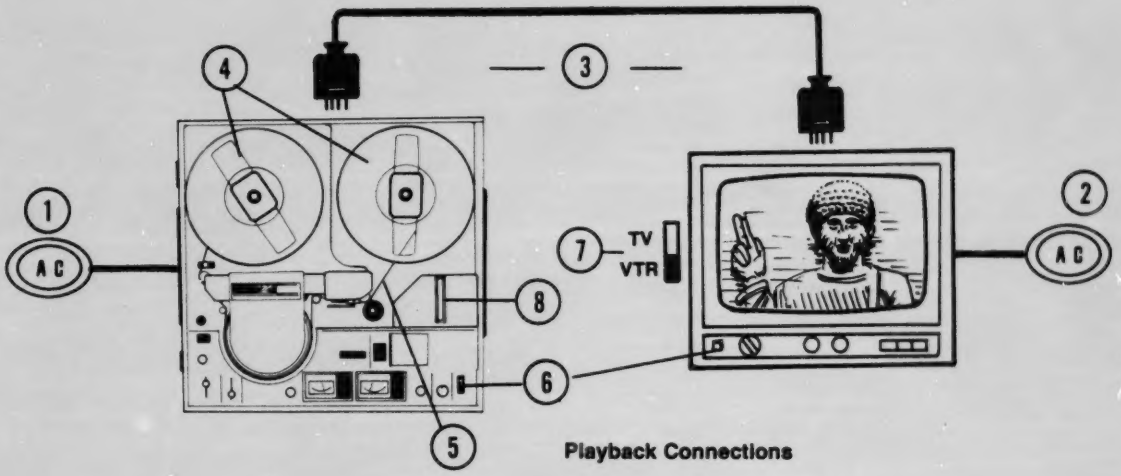
Plugs and Wires Needed:
- 1 AC POWER cord for VTR
- 1 8-Pin connector or RF Adaptor connector cable or 1 UHF or BNC Coax cable for video and an audio cable for sound with Mini, RCA or Cannon connectors.

Accessories:
- 1 Take-up reel



Playback Procedure

First, read Instruction Manual thoroughly.



Playback Connections

Step 1 Plug the AC power cord into the VTR and the AC outlet.

Step 2 Plug the monitor power cord into the VTR or other AC outlet.

Step 3 Plug the 8-Pin TV/VTR connector into the VTR and the TV monitor, or connect the RF unit.

Step 4 Place the videotape supply reel and the take-up reel on the VTR.

Step 5 Thread the videotape.

Step 6 Turn on the VTR and the monitor.

Step 7 Turn the TV/VTR switch on the monitor to the VTR position.

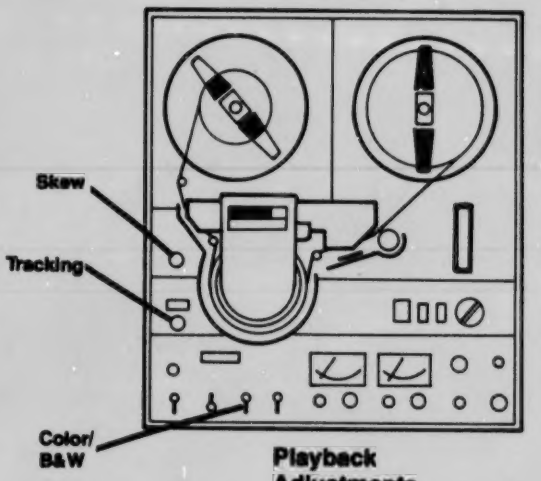
Step 8 Place the VTR in PLAY or FORWARD mode.

SPECIAL PLAYBACK ADJUSTMENTS

Still Picture

A still picture can be obtained at any time during playback by moving the FUNCTION SELECTOR LEVER to the PAUSE mode. Often a line will appear in the still picture, but it can be minimized or eliminated by hand rotating the reels until the line of distortion disappears. *Do not* still-frame longer than a minute or so as the tape wears excessively during still-framing, because the video heads actually touch the videotape when scanning.

NOTE: Clean still-framing can only be obtained with pictures recorded from a 2:1 INTERLACE SYNC camera. Pictures recorded from a RANDOM SYNC camera will not still frame.



Playback Adjustments

Tracking

The tracking control adjusts the VTR for tapes made on other compatible (or same format) VTRs. Observe the picture playback for excessive noise bands or distortion. Turn the tracking knob until the distortion disappears. VTRs in proper condition rarely should need tracking adjustments.

Adjust Tracking **Normal** **Adjust Skew**

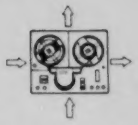
Skew

The skew control adjusts the tension of the tape against the video head drum. Adjust the skew if the top of the playback picture appears to bend to the right or to the left. Turn the skew knob to the right or to the left until the picture straightens out.

What is Skew Error?

In simple terms, skew errors result from any change in the length of the video track on the tape between the time it was recorded and the time it is played back. A skew error shows as a hooking in the picture at the top of the TV monitor during playback. If the picture hooks to the left, the video track on the tape is longer than the playback track length of the machine. If the picture hooks to the right, the video track on the tape is shorter than the playback length of the machine.

The amount of skew error will depend on the type of monitor or TV set used. The Sony Trinitron or other newer type Japanese TV sets or monitors have SHORT TIME CONSTANTS in their horizontal scanning circuits and thus will display only a slight distortion when playing back a tape containing skew errors. Older type monitors or American TV sets will bend considerably or lose horizontal lock completely. *See Chapter 8—TV Monitors and Video Projectors, p. 98.*



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Usually there is a wide variation in tape tension (skew) from one VTR to another so the skew control must be constantly adjusted. Failure to properly adjust the skew during editing can result in serious problems to the editing tape.

Skew error can be caused by the tape or by the machine. A skew error caused by the tape is due to dimensional change induced by heat (a temporary change) or shrinkage of the tape backing (a permanent change). A very slight dimensional change in the tape can produce significant skew errors.

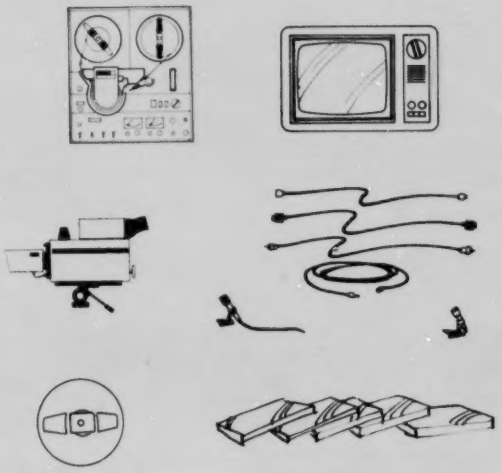
VTR skew errors are caused by improper tape tension mechanics or machine contraction produced by temperature. Incorrect tape tension around the VTR head drum will stretch or relax the tape which will in turn change the video track length. VTR tension should be adjusted carefully and precisely on a regular basis to minimize skew variations from machine to machine.

Recording with the VTR

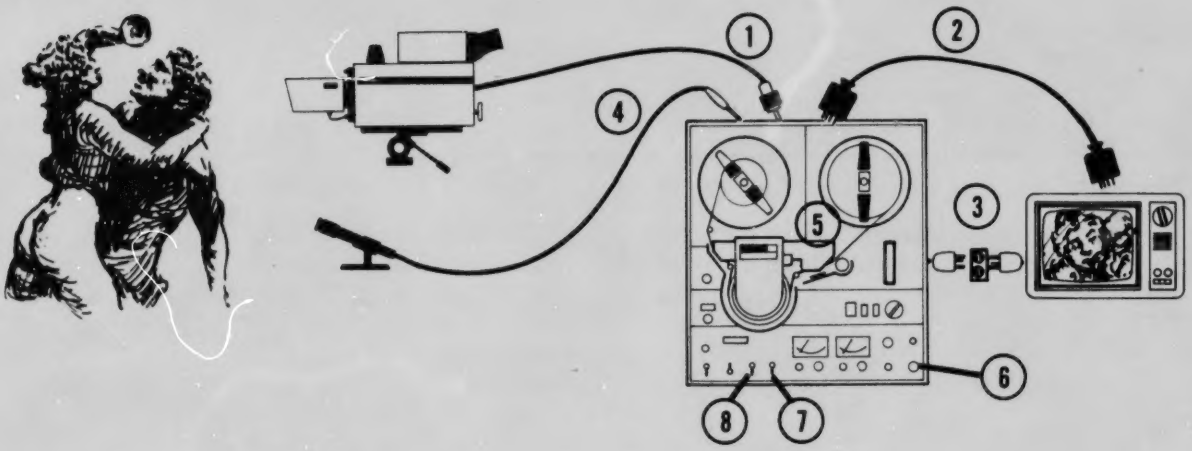
Equipment Needed:
- 1 VTR
- 1 Monitor
- 1 Video camera and Lens
- 1 Microphone
- 1 Tripod for Camera

Plugs and Wires Needed:
- 1 AC CORD for VTR
- 1 8-Pin TV-Monitor connector
- 1 Camera cable, either 6-Pin or UHF cord
- 1 30 foot microphone extension cable

Accessories Needed:
- 1 take-up reel
- Videotape



Recording Connections



Video Recording Connections and Set Up

Recording Procedure

Read the Instruction Manual first!

Step 1 Connect the camera to the VTR with a camera cord (UHF or 6-Pin).

Step 2 Connect the VTR to the monitor with the 8-Pin cable.

Step 3 Connect the AC power cables.

Step 4 Connect the microphone to the VTR.

Step 5 Thread the tape and set the tape counter to 000.

Step 6 Turn everything on.

Step 7 Set the input selector switch to CAMERA (6-Pin only types) or LINE if recording from a camera or a VTR or to TV if recording off-the-air.

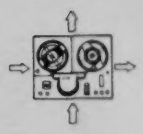
Step 8 Select proper recording mode (for color VTRs only). Select COLOR mode if recording color or B&W mode if recording b&w.

Step 9 Depress the RECORD button until it locks into position. The red recording light will come on and the picture should appear on the TV monitor. Make your video and audio adjustments at this time. The VTR is now ready to record.

Step 10 To begin recording, hold down the RECORD button with one hand and turn the FUNCTION LEVER to the FORWARD or PLAY position with the other hand. The picture and sound are now being recorded simultaneously.

Step 11 Adjust the audio and video levels if operating with manual audio and video controls. Adjust the control knob so that the needle barely hits the red zone on peak sounds.

Step 12 At the end of the recording, place the FUNCTION LEVER in the STOP position. Rewind the tape and watch the playback.



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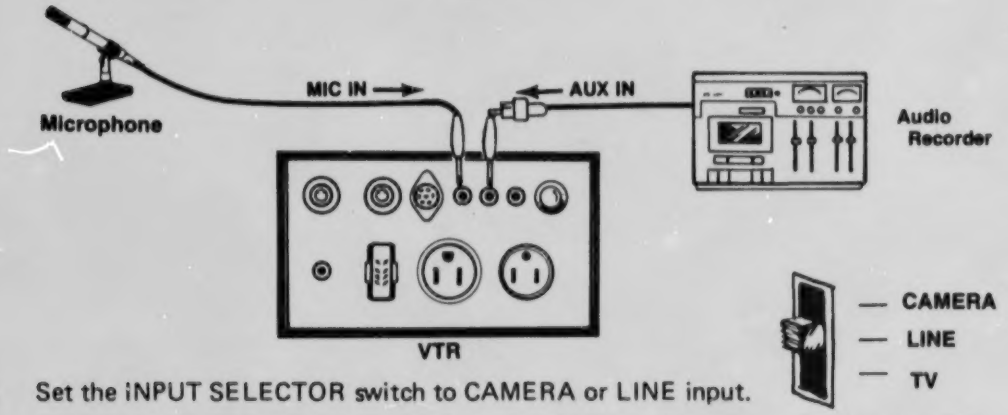
Audio Dubbing

On nearly all recording VTRs, new sound can be added or DUBBED after the initial recording without erasing the picture. However, the original sound is erased on that portion of the recording where the new sound is added.

To Add New Sound

Step 1 Plug in the microphone to the MIC IN input or plug a tape recorder into the AUX IN input on the VTR. Only *one* audio input can be used at one time.



Step 2 Set the INPUT SELECTOR switch to CAMERA or LINE input.

Step 3 Play back the prerecorded tape, and when the proper scene appears, *stop the VTR.*

Step 4 Depress the AUDIO DUB button and simultaneously place the FUNCTION lever in the FORWARD or PLAY mode.

NOTE: If using the manual control for audio, be sure to match the level of the new sound with the preceding level. Use the meter to check the level of the preceding sound and then match the new sound to the same level.

Step 5 When the new sound recording is finished, turn the FUNCTION lever to the STOP position, rewind the tape, and play back the sequence. This procedure can be repeated as many times as desired.

Erasing the Tape

The simplest method for erasing a tape is to unplug all inputs to the VTR and run the machine in the RECORD mode. There is a more professional way to do this, however, and that is to RECORD BLACK or a solid dark blank which then appears on the monitor instead of the plain static or random noise which is generated from an unrecorded part of the tape. The neater blank or BLACK is created prior to the program and after it by either of two methods:

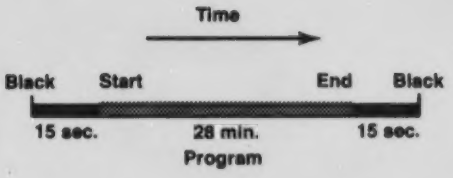
Method No. 1

Switch both audio and video recording controls to MANUAL CONTROL and turn both manual controls all the way down to the 0 level. Then place the VTR in the RECORD mode.

Method No. 2

Plug a camera into the VTR. Place a lens cap on the camera and turn the camera ON. Then place the audio control on MANUAL and turn it down to the 0 level. Now place the video control on AGC/AUTO or set the MANUAL control for the proper video level. Finally, place the VTR in the RECORD mode.

Method 2 is the best way of recording black because the sync is actually being recorded on the tape from the camera. The sync provides the VTR with something to lock-up to while recording. It's always a good idea to record 10 to 15 seconds of BLACK on both the beginning and the end of the program.



Typical ½-Hour Program

Fade-In, Fade-Out Procedure

Your program will look more professional if it fades in at the beginning and fades out at the end.

Step 1 Plug in the camera.

Step 2 Turn on the camera.

Step 3 Leave the lens iris fully closed or the lens cap on the camera.

Step 4 Place the VTR in RECORD mode for 10 to 15 seconds.

Step 5 Remove the lens cap quickly from the camera, or open the lens iris and immediately cue the action to begin.

Step 6 Complete taping the action.

Step 7 Replace the lens cap or close the lens iris at the end of the action.

Step 8 Allow the VTR to continue running in BLACK for 10 to 15 seconds.

NOTE: Do not fade out by turning the MANUAL VIDEO knob to "0" (zero) as the video sync pulses (control track) will be reduced to zero and the video image will become unstable.

Bulk Erasing

Sometimes it may be desirable to erase the entire tape at once. Bulk erasers can be purchased that erase a 60 minute tape in seconds.

Bulk Eraser

SPECIALIZED VIDEO RECORDING SYSTEMS

There are several kinds of low-to-moderate cost VTRs that offer specialized options that are most useful to program production.

Editing VTRs

Videotape is edited by copying out or assembling the best segments from a series of master tapes onto a blank tape. This ASSEMBLY process requires a rerecording of the taped footage to be made on a second EDITOR VTR. Thus you need 2 VTRs for editing videotape—one to play back the master tapes and one to rerecord the newly edited tape. The playback machine can be any VTR on which the tapes will successfully play back, but the second VTR must be an EDITOR VTR which has special editing features.

An electronic editing VTR must have a CAPSTAN SERVO mechanism which essentially enables the VTR to do 2 things at once—1) monitor the tape that is being played back, and 2) simultaneously reference or "LOCK UP" to the sync coming from the other VTR, so when the command to edit is given, the new material can be smoothly added to the previously edited sequence of material without producing a GLITCH or distortion at the edit point. All electronic editing VTRs must be capstan servo VTRs, otherwise they cannot perform smooth edits.

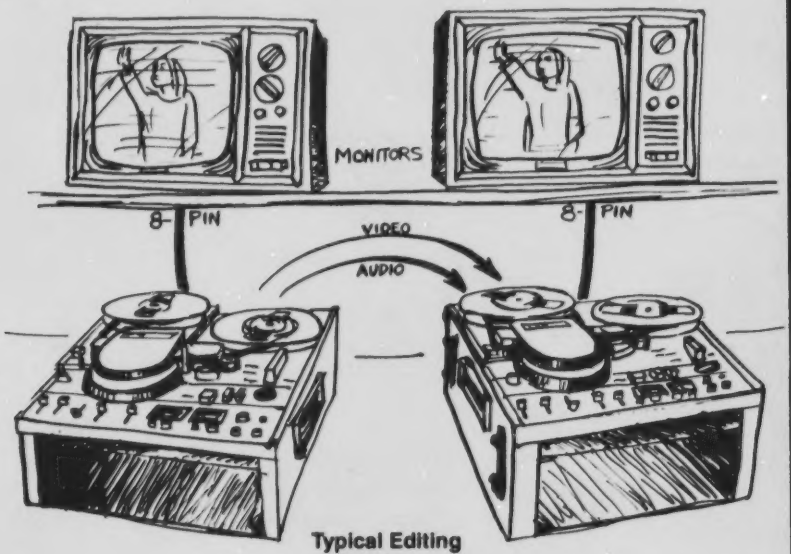
It's also very beneficial to use a capstan servo VTR as your playback VTR as well, because tapes will always be more stable (have better sync) when played or recorded on capstan servo VTRs. The more stable your tapes are the better your edits will be. So, use 2 capstan servo VTRs for the best editing results.

The other important feature of an editing VTR is its ability to edit video and audio information onto a tape in a variety of sequences. These editing modes are called ASSEMBLY and INSERT EDITING and refer to the sequential process of adding and changing scenes on an edit tape. A good editor VTR is able to edit video and audio tracks individually and/or simultaneously without delays, glitches or pops at the edit points.

The best editing reel-to-reel VTR for the price is the ½-inch EIAJ Sony AV-8650. The AV-8650 performs flawless editing 98% of the time with absolutely no audio abnormalities. The edit control switch on the AV-8650 permits any combination of assembly/insert mode—video/audio editing that is possible on ½-inch tape. It's a superb machine; it's one of Sony's best designs; and it delivers high quality color especially in the high-density mode.

¾-inch editors are numerous and include the Sony VO-2800, VO-2850, VO-2860, the JVC CR-8500LU, and the Panasonic NV-9500. *See Chapter 11—Videocassette Editing, p. 143.*

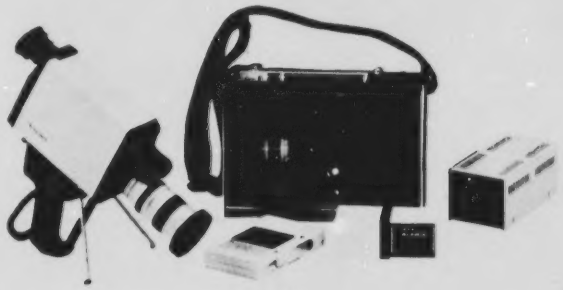
Sony AV-8650 Color Editor



Typical Editing Set-Up

Slow Motion VTRs

There is more to video slow motion than merely slowing down the tape. The scanning of the tape by the video heads must be altered, otherwise objectional frame lines will appear on the screen. Certain VTRs have eliminated this problem by using 4 video heads and a special scanning process which produces a clean, true slow motion at 1/6th normal speed. Popular true slow motion ½-inch VTRs include the Javelin X-400 ($2,000) and the Sanyo line of slow motion VTRs, such as the non-EIAJ Sanyo ½-inch portapak.



Sanyo VTC-7150
Videocassette Recording System

Slow Motion Video

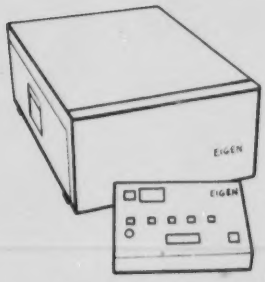
The practical use of video for slow motion has been inherently limited because of its slow scanning speed of only 30 frames per second. Anything that moved fast would therefore be blurred to the video camera. Sony, though, developed a combination video motion analyzer/ videostrobe system that effectively increases the speed of the video system. By using a unique b&w camera with a rotary shutter that shoots at a considerably higher speed than 30 frames per second, very fast action can be recorded without blur.

The system consists of the RSC-1010 b&w video camera and SVM-1010 video motion analyzer with built in b&w battery powered monitor with full-function remote control. The pictures from the camera are recorded on a special magnetic sheet located in the monitor unit. Up to 10 seconds of action can be recorded on the sheet and played back in real time (normal speed), in 1/7th or 1/15th slow motion speed, in forward or quick reverse, or the motion can be advanced, reversed and analyzed frame by frame, The whole system is battery operated, and the recorder and camera output can be connected to any VTR. A strobe input enables the camera to be synchronized with an external strobe lamp for greater versatility. A system such as this is ideal for industrial or sports motion studies.

Sony Video Motion Analyzer

Slow Motion Videodiscs

The videodisc is much better suited to producing special video playback effects. The MAGNETIC VIDEODISC process is utilized by broadcast TV networks for the instant replay of sports events. The video pictures are stored on a magnetic disc instead of magnetic tape and can be replayed at any speed or stopped on a single frame. These machines are very sophisticated and expensive.



Eigen Magnetic Videodisc System

A less expensive ($15,000) version of the Broadcast Videodisc System is manufactured by the EIGEN COMPANY, P.O. Box 1027, Grass Valley, CA 95945. The Eigen color disc recorder records individual TV fields on single tracks, thereby reproducing perfect still images when played back. The tracks are recorded in a series of concentric circles on the magnetic disc.

Time Lapse VTRs

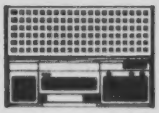
Another way to use a slow motion VTR is to record in the slow motion mode and then play the tape back at normal speed. The effect will be a picture of greatly accelerated motion—many times the normal speed. A good slow motion VTR is a very helpful tool for creating slick special effects, since these effects can be edited into the videotape production.

The Panasonic NV-8030 time lapse VTR provides continuous taping of up to 108 hours with a standard 60 minute roll of ½-inch tape. The NV-8030 has several selectable speed modes and can record only one single field at a time. This is called the "1-shot" mode. A built-in alarm and alarm memory permit rapid tape search for periods recorded during alarm conditions. This kind of VTR is normally used for surveillance applications but could also be used to produce some interesting production effects.

Summary

Since ½-inch EIAJ VTRs have been around and standardized for a while, they offer a great deal of flexibility for the lowest cost. For basic b&w production, surveillance, or "video work print" purposes, the ½-inch reel-to-reel can't be beat. For more sophisticated video production, particularly color work, the ¾-inch videocassette systems are more appropriate, and the ½-inch videocassette systems are more practical for low-cost program distribution.

So, let's move on to some basic videocassette equipment and explore its operation and set-up.



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Chapter 11
Basic Videocassette Systems

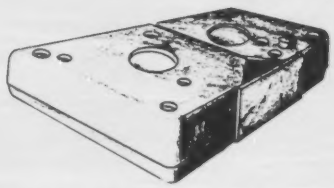
Videocassette recording and playback systems represent a significant advance over ½-inch EIAJ systems. Since the tape remains in a sealed container and is threaded automatically in a videocassette system, the trouble-free life of the tape and the video unit is greatly extended. Videocassette machines are particularly ideal for playback and recording situations where a variety of untrained people must operate a video machine.

U-Matic ¾-Inch Videocassette Recorders

The operational controls on a U-Matic ¾-inch VCR (Videocassette Recorder) differ somewhat from one series of the same machine to another and also within the same manufacturer's models. Nevertheless, all videocassette machines must include additional controls such as PAUSE/STILL FRAME, RECORD, AUDIO DUB, and EDIT. Also, VCR plugs and connectors are basically identical to reel-to-reel VTRs. Earlier model Sony VCRs such as the VP-1200, VO-1600 and VO-1800 utilized mechanical function buttons which required the operator to wait between modes to prevent the machine from jamming. The Sony Type II machines and most JVC VCRs feature feather-touch SOLENOID CONTROLS and LOCK-OUT LOGIC which nearly eliminate operator control error.

Special Features of Most Sony Type II and other sophisticated VCRs:

- LOGIC CONTROL SYSTEM—A LOCK OUT LOGIC feature prevents the activation of the "wrong button." Any button can be pressed at any time without going first to the STOP mode or damaging the tape or the machine. The logic control circuits remember which buttons have been pushed but permit only the correct sequence of machine operations to occur, thus eliminating any chance of operator-control error. Most of us could surely use one of these, couldn't we?
- IMPROVED PICTURE QUALITY and Signal-to-Noise Ratio—Type II VCRs have a 45 db signal-to-noise ratio vs. 40-42 db for EIAJ VTRs. An increase of 5 db represents a noticeable and significant increase in picture quality and purity. This improvement allows copies to be made with very little loss in quality.
- PAUSE CONTROL—The tape motion can be stopped or started in either recording or playback mode without dethreading the tape. This is an essential feature for cueing or editing.



VCR Cassette

- AUTO/MANUAL LIMITER for Audio Recording—This control allows the selection of automatic or manual modes for audio recording. When the limiter is on, high level peaks and distortion are reduced without altering the dynamic range of the sound. Older AGC (automatic gain control) circuits would boost low sounds and extraneous noise, causing undesirable audio elements to be recorded on the tape.
- FULL AUTOMATIC REWIND—When the tape stops at the end of the program, the machine rewinds it automatically.
- AUTOMATIC REPLAY/CONTINUOUS REPLAY—The machine rewinds and continuously replays the tape. This is very useful for sales demonstrations and informational situations.
- PROGRAMMABLE MEMORY—The VCR will automatically return to a preselected point in the tape.
- REMOTE CONTROL—Optional remote control devices allow computer or distant operator control of the machine's tape functions.

¾-Inch Videocassette Comparison Chart

	Type	Built in Timer	Built in TV Tuner	Built in RF Adapter	RF Capable (optional	Auto Rewind (at end of tape)	Auto Repeat	Solenoid Operated	Still Frame/ Pause	Remote Control	Auto Search/ Memory	Improved Signal to Noise - 45 db	Logic in Controls	Auto/Man Audio Limiter	Electronic Editing
SONY															
VP-1200*	PLAY	NO	NO	YES	–	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
VO-1600*	REC	NO	YES	YES	–	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
VO-1800*	REC	NO	NO	YES	–	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO
Type II															
VP-2000	PLAY	NO	NO	NO	YES	YES	NO	YES	YES	YES	NO	YES	YES	NO	NO
VO-2600	REC	NO	NO	NO	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES	NO
VO-2800	REC	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
VO-2850/60	REC	NO	NO	NO	NO	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES
Type III (portable)															
VP-3000	PLAY	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
VO-3800	REC	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
Sony BVU															
BVU-200	REC	NO	NO	NO	NO	YES	NO	YES	YES	YES	NO	YES	YES	YES	YES
BVU-100	REC	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	YES	NO
PANASONIC															
NV-2110M*	PLAY	NO	NO	YES	–	NO	YES	YES	NO	YES	NO	NO	YES	NO	NO
NV-2120*	REC	NO	NO	YES	–	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NV-2125*	REC	NO	YES	YES	–	YES	YES	YES	NO	YES	YES	NO	YES	NO	NO
NV-9100	PLAY	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO
NV-9200	REC	NO	NO	NO	NO	YES	NO	YES	YES	YES	YES	YES	YES	YES	NO
NV-9300	REC	NO	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO
NV-9500	REC	NO	NO	NO	NO	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES
NV-9400 (portable)	REC	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	NO	YES
JVC															
CP-5000U	PLAY	NO	NO	NO	YES	YES	YES	YES	NO	YES	NO	NO	YES	NO	NO
CP-5200U	PLAY	NO	NO	NO	YES	NO	NO	YES	YES	YES	NO	NO	YES	NO	NO
CR-6060U	REC	YES	NO	NO	YES	NO	NO	YES	YES	YES	NO	NO	YES	YES	NO
CR-6100U	REC	YES	YES	NO	YES	YES	YES	YES	NO	YES	YES	NO	YES	NO	NO
CR-6300U	REC	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	NO	NO
CR-8300U	REC	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
CR-4400U/LU (portable)	REC	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO	YES	YES

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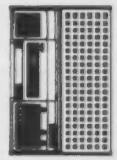
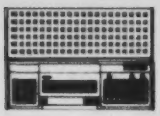
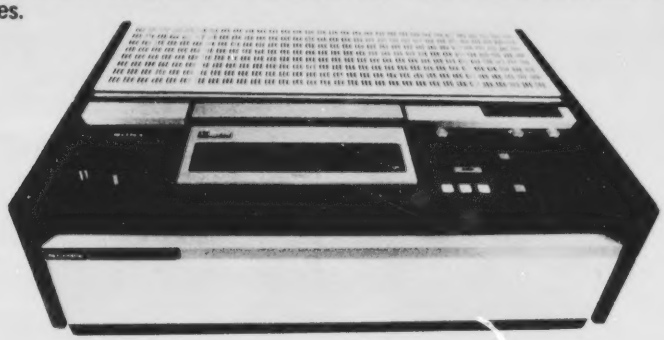


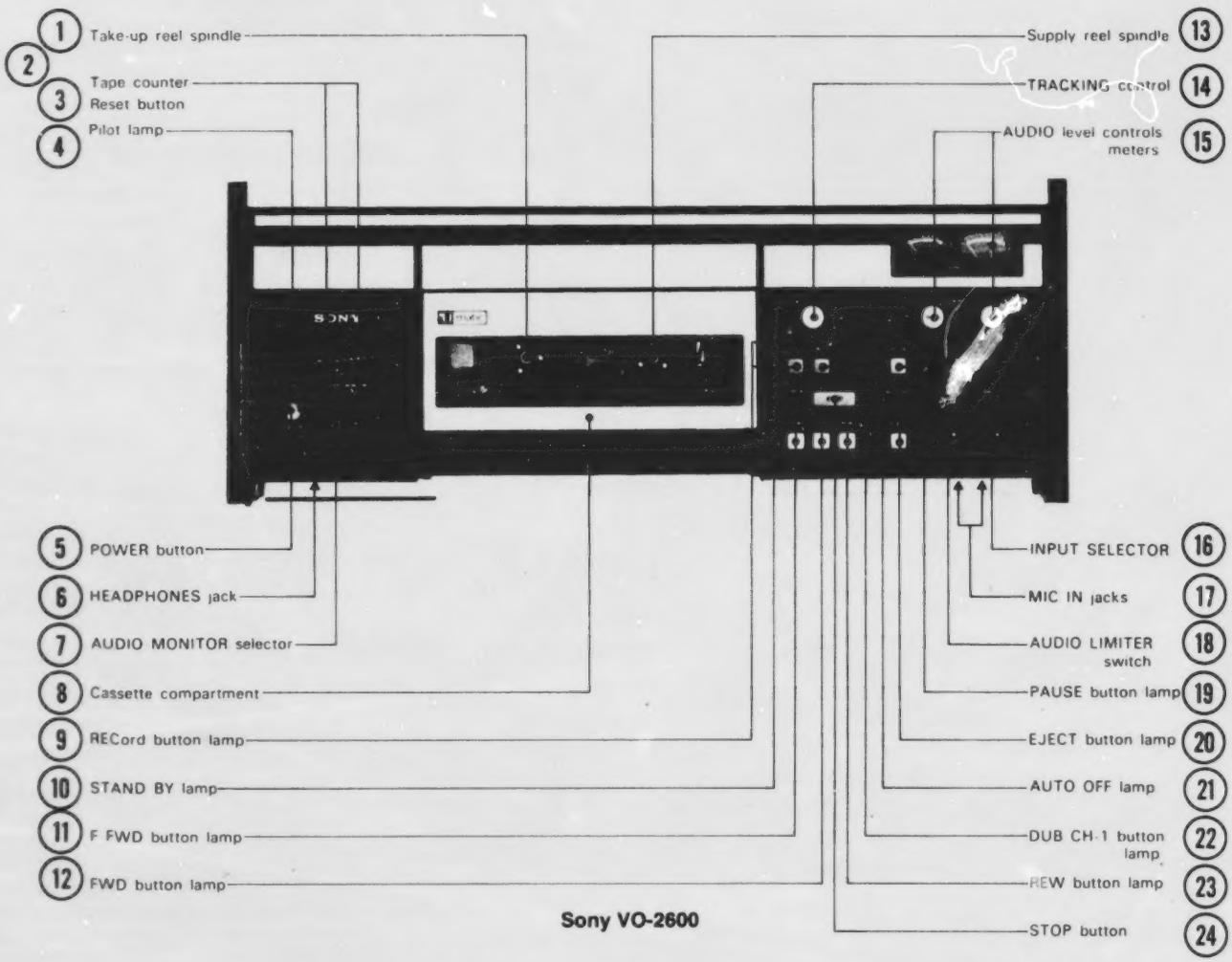


U-Matic Videocassette Systems—Controls and Operations

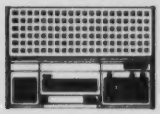
We will feature the Sony VO-2600 VCR because it is a Type II VCR, and its controls and operations are representative of most popular videocassette machines.



LOCATION OF PARTS AND CONTROLS



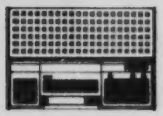
Sony VO-2600

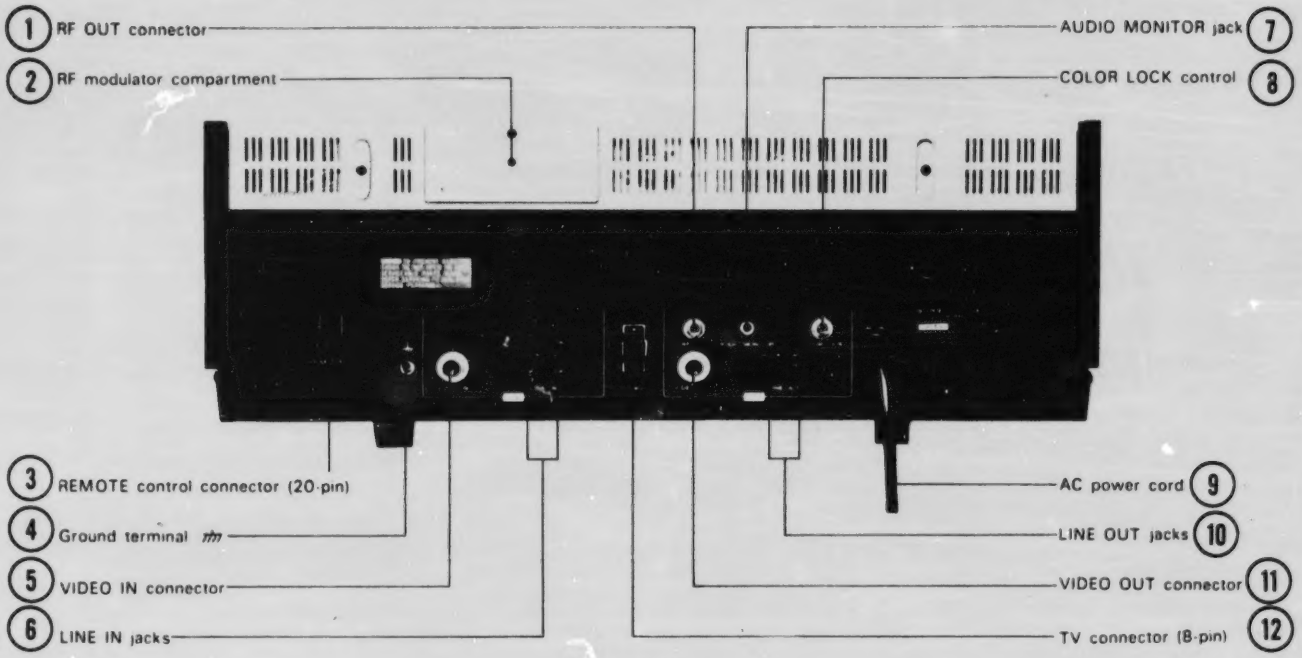


Sony VO-2600 Controls

1. TAKE-UP REEL SPINDLE—A full reel of tape goes here.
2. TAPE COUNTER—Indicates the amount of tape used. Always reset to 000.
3. TAPE COUNTER AND RESET BUTTON—Push button to 000 at start of first picture.
4. PILOT LAMP—Indicates the VCR is *ON.*
5. *POWER* BUTTON—Depress to turn on the VCR.
6. *HEADPHONES* JACK—Use low impedance 8 ohm headphones.
7. *AUDIO MONITOR* SELECTOR—Allows selection of audio track No. 1, track No. 2 or a MIX of both. The switch does not operate in RECORD mode.
8. CASSETTE COMPARTMENT—Insert a videocassette here.
9. *REC*ORD BUTTON/LAMP—Places the VCR in RECORD mode. The indicator lamp will light.
10. *STAND BY* LAMP—Indicates the VCR is in the process of threading the tape.

    NOTE: The stand by lamp will light and stay lit when the special tape protection device is activated if improper tape motion is sensed. If this happens, rewind and play the tape again. If the machine stops automatically a second time at the same spot, try another tape. *See Videocassette Winding Problems—Chapter 14, Maintenance and Troubleshooting.*
11. *F. FWD* BUTTON/LAMP—Commands the VCR to wind the tape forward at high speed.
12. *FWD* BUTTON/LAMP—Places the VCR in PLAY mode for standard recording and playback.
13. SUPPLY REEL SPINDLE—An empty reel of tape goes here.
14. *TRACKING* CONTROL—Operates in playback mode only. Adjust this control if the picture is distorted, otherwise leave the control in the FIX position.
15. *AUDIO* LEVEL CONTROLS AND METERS—Allow manual or automatic control of audio levels. Adjust each control so the sound level averages at "0" db.
16. *INPUT SELECTOR* SWITCH—Use *LINE* position for camera or second VTR. Use *TV* for recording off-the-air with a TV tuner or monitor/receiver.
17. *MIC IN* JACKS—Plug 1 or 2 microphones in here. Use microphones with mini jacks and 250 to 600 ohm impedance.
18. *AUDIO LIMITER* SWITCH—In the *ON* position, the limiter will reduce the peak sounds that are too loud but will not affect the quiet sounds. This switch is best left in the *ON* position for most circumstances. The manual control usually works best when recording with live microphones. *Always* make a test recording *first* and try recording *with* the limiter and *without* it. See which method works best.
19. *PAUSE* BUTTON/LAMP—Activating PAUSE causes the tape to stop and display a still frame. This only works with tape designed for still frame picture playback, such as the KCA series videocassette tapes and most post-1975 tapes designed for this purpose. Older non-still frame tape will cause the VCR to black out the picture until the PAUSE control is reactivated.
20. *EJECT* BUTTON—Push to eject tape. The button can be activated while the machine is in operation for all Type II series VCRs.
21. *AUTO OFF*/LAMP—The illumination of this lamp indicates activation of a moisture sensor which temporarily disables the VCR in case of condensation on the video head drum surface. If the light comes on when the power switch is depressed, *turn the power off* and wait 10 minutes and then restart the machine. When the light is on, do not try to remove or to insert the videocassette. The AUTO-OFF lamp will also be activated when the automatic stop mechanism at the end of the tape fails. When this failure occurs, the machine will become deactivated and must be taken to a Sony Service Station for repair.
22. *DUB/CH-1* BUTTON/LAMP—Allows audio to be added later to track No. 1 during playback.
23. *REW*IND BUTTON/LAMP—Allows rewinding of the tape.
24. *STOP* BUTTON—Stops the tape motion.

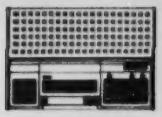



1 RF OUT connector
2 RF modulator compartment
3 REMOTE control connector (20-pin)
4 Ground terminal
5 VIDEO IN connector
6 LINE IN jacks
AUDIO MONITOR jack 7
COLOR LOCK control 8
AC power cord 9
LINE OUT jacks 10
VIDEO OUT connector 11
TV connector (8-pin) 12

VO-2600

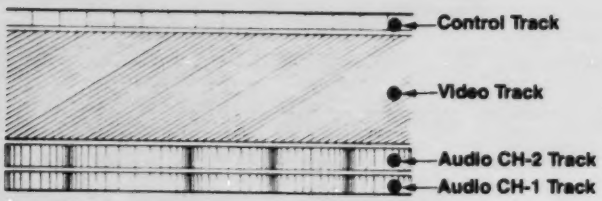
Connectors:

1. *RF OUT* CONNECTOR—Insert an RF cable here and connect it to a TV set.
2. *RF* ADAPTOR COMPARTMENT—Insert optional RF unit.
3. *REMOTE CONTROL* CONNECTOR—Connect the 20-Pin optional remote control unit (Sony RM 420) here.
4. *GROUND* TERMINATION—Connect a wire to a good ground if a hum is present in the audio.
5. *VIDEO IN* CONNECTOR—Plug in a camera or a VTR here; this connection brings only *video* into the VCR.
6. *LINE IN* CONNECTOR—Use this input to transfer sound into the VCR from a microphone mixer or output (LINE OUT) of a second VTR. *DO NOT* plug a microphone in here. Either audio track can be used separately, or both utilized simultaneously except when audio dubbing.
7. *AUDIO MONITOR* JACK—Connect to an audio input on a TV monitor if needed.
8. *COLOR LOCK* CONTROL—*Do not adjust* unless the correct hues cannot be maintained. Use a small screwdriver and turn the knob until the colors stabilize. The control should remain in the DETENT (notched) position.
9. *AC POWER* CONNECTION—Connect to a wall socket with the AC cord.
10. *LINE OUT* JACK—This output carries the sound out of the VCR. Connect it to a stereo amplifier or a second VCR.
11. *VIDEO OUT* JACK—This output takes the video out of the machine.
12. *TV* 8-PIN CONNECTOR—Connect to a video monitor or monitor/receiver.

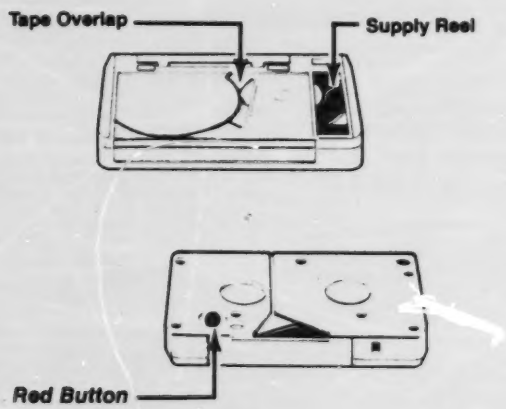


Videocassette Tape Information

The full width of the tape is used for recording, and the tape cannot be used in the reverse direction. You cannot "turn over and record on the other side" as with audiotape.

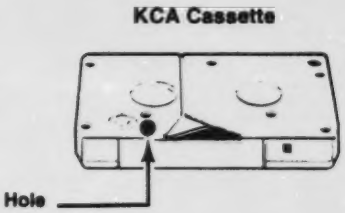


Always rewind the tape fully for storage and mailing and store the videocassette in its case. If tapes are not rewound, they tend to develop slack on the reel, which causes the automatic devices on the VCR to shut down the machine and stop the tape as it is playing. Sometimes the tape will not play until it is run in the F. FWD and REWIND modes several times to even out the tension in the tape. This happens primarily because of the overlapping design of the two reels inside the cassette.

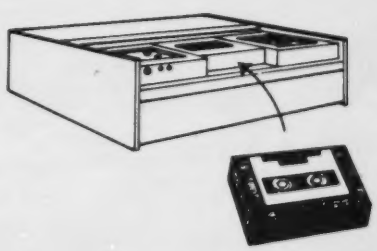


All videocassettes contain a red safety button on the bottom of the tape to prevent accidental erasure. *This red button must be in place to initiate any recording on the tape.* Once you are finished recording, remove the red button to safeguard the tape, otherwise the taped material will be erased when the VCR is placed in the RECORD mode.

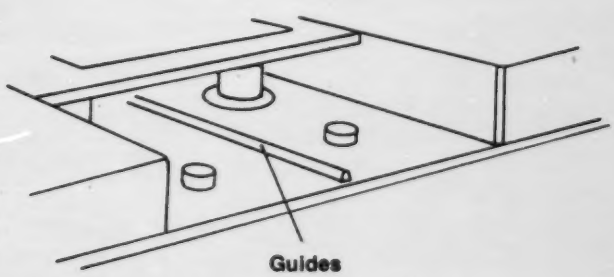
Use only KCA or KCS series videocassettes if still framing is required. These tapes are specially formulated for the heavy abrasion and wear produced on them during still framing. A small access hole underneath the cassette activates a sensor which allows the picture to appear. Older cassettes such as the KC series will not display a picture during the PAUSE mode because these cassettes do not contain the special indicator hole.

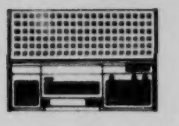


The smaller and more compact series KCS ¾-inch videocassettes will also play on any large VCR. However, Sony recommends the use of the KA-1 adaptor to insure a better fit and protection of the delicate plastic guide that keeps the small cassette in its correct alignment.



Insertion Of Videocassette





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VIDEOCASSETTE OPERATIONS PROCEDURES

Inserting and Removing the Cassette—Sony Type II Systems

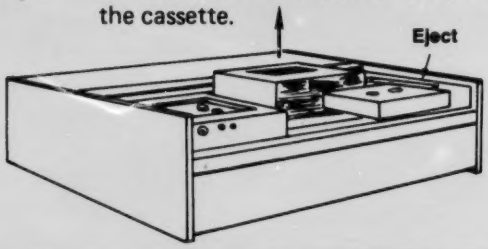
Step 1 Turn the VCR *ON*.

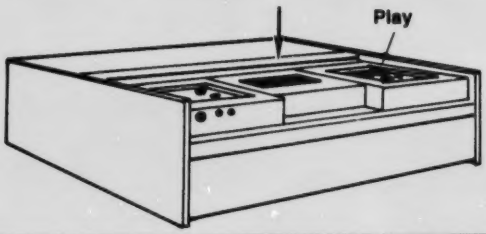
Step 2 Press the EJECT button and the cassette carriage will pop up.

Step 3 Insert the cassette, pushing it back as far as it will go.

Step 4 Press down the cassette compartment until it drops into the PLAY position.

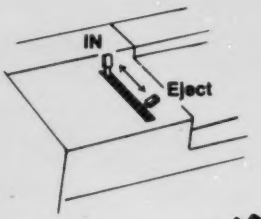
Step 5 Push the EJECT button to remove the cassette. The power must be *ON* to remove the cassette.





Procedure for Inserting and Removing Cassette—Sony pre-Type II Systems and All JVC Systems:

Note: *VCR need not be on*



Step 1 Pull the EJECT lever forward and the carriage will pop up.

Step 2 Insert the cassette, and push it back as far as it will go.

Step 3 Press down the cassette compartment until it drops into the PLAY position.

Step 4 Pull the EJECT lever when the tape is finished and the stand by light goes out.

Step 5 Remove the cassette.

CAUTION: The cassette carriage drops fast, so get your hands out of the way rapidly after you push the cassette in—it bites!

Panasonic Automatic Elevator

Step 1 Turn the VCR *ON*.

Step 2 Push the EJECT button and wait for the cassette elevator to rise into position and stop.

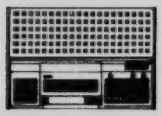
Step 3 Insert the cassette, pushing it as far back as it will go, and then push the PLAY button.

Step 4 Push the EJECT button to raise the elevator again.

Step 5 Remove the cassette.

CAUTION:

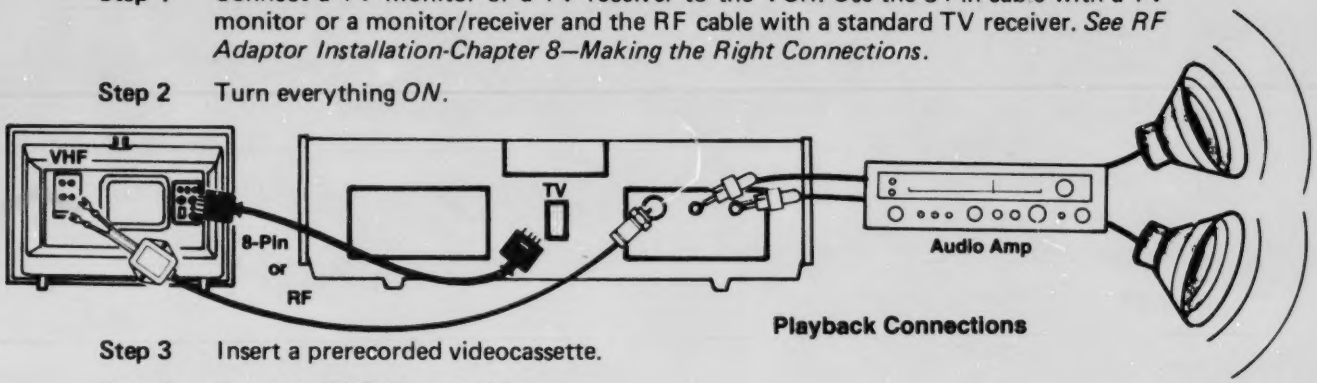
- Before turning off the power, be sure to remove the cassettes from the Sony Type II and Panasonic automatic elevator VCRs.
- *Be gentle*—avoid subjecting the cassette compartment to unnecessary shock or impact.
- *Use extreme care* when inserting compact cassettes into the large cassette carriages, or you will break off the fragile plastic guide strip on the bottom of the cassette compartment. This will necessitate complete replacement of the cassette carriage. If the guide is broken, the compact cassettes will not line up properly with the threading mechanism.



VIDEOCASSETTE OPERATION—Playback Mode—All Models:

Step 1 Connect a TV monitor or a TV receiver to the VCR. Use the 8-Pin cable with a TV monitor or a monitor/receiver and the RF cable with a standard TV receiver. *See RF Adaptor Installation-Chapter 8—Making the Right Connections.*

Step 2 Turn everything *ON*.



Playback Connections

Step 3 Insert a prerecorded videocassette.

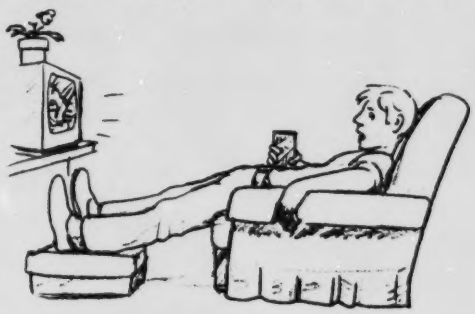
Step 4 Press the FWD (forward) button.

Step 5 Adjust the AUDIO MONITOR Selector on the VCR to the proper position—usually the MIX mode.

Step 6 Adjust the sound level on the monitor or the TV set. The audio level meters will indicate the levels in playback mode, but are not affected by the controls. This is a good way to know whether or not there is a program on the tape, and the VCR is in fact playing the program.

Step 7 Sit back, relax and enjoy the program.

Step 8 At the end of the tape, the VCR will stop automatically. Rewind the tape and remove the cassette. The tape may be stopped and restarted at any point in the playback by pushing the STOP or PAUSE button. Push the PAUSE button a second time to restart the tape.



CAUTION: Do not hold the PAUSE mode for more than 30 seconds as this may clog the video heads.

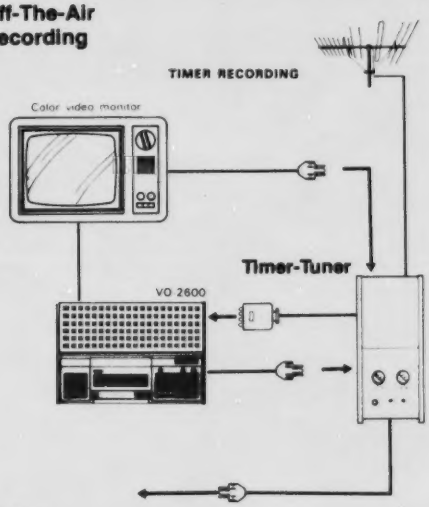
VIDEOCASSETTE OPERATION—

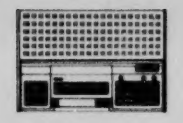
Record Mode—All Models

Recording Off-The-Air

The discontinued Sony VO-1800 and all Type II recorders require an external or "outboard" TV TUNER to receive off-the-air TV programs. The Sony recorders can use the discontinued TT-100 tuner/timer or the newer TT-300 LED display 2-hour automatic shut-off tuner/timer. If only a timer is needed, you can use the DT-10A digital timer. Automatic unattended recording can then be made with any Sony U-Matic recorder with the supplied FA-2A timer recording adaptor.

Off-The-Air Recording





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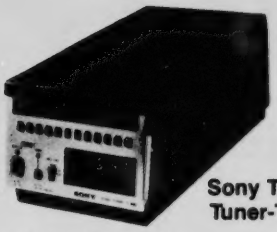


Sony TT-300
Tuner-Timer

Recording Procedure with Timer-Tuner

Step 1 Connect the tuner to the VCR.

Step 2 Turn everything *ON*.

Step 3 Adjust the tuner to the correct TV channel.

Step 4 Insert the cassette and make sure the red safety button is in place.

Step 5 Set the VCR INPUT SELECTOR to the *TV* mode.

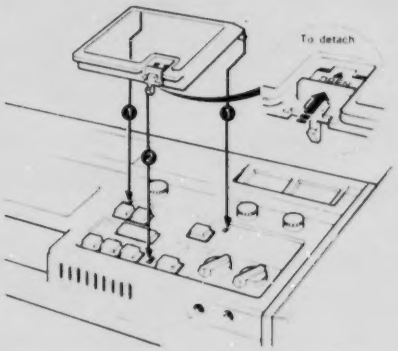
Step 6 Adjust the audio level if necessary.

Step 7 Set the turn-on time on the timer (leave the recorder *ON*).

Step 8 Turn off the video monitor or the TV set.

Step 9 Attach the FA-20 TIMER RECORDING ADAPTOR. The Recorder will start and record at the preset time. At the end of the tape, the VCR will stop automatically, but it will not rewind until the recording adaptor is removed.

NOTE: Playback with the preset timer is possible when the red button on the bottom of the cassette is removed.



Internal Timer-Tuner Systems

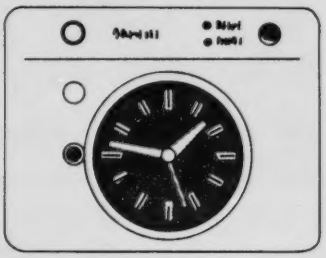
Many VCRs do not require external timer and tuners as they are built in. Examples are the Sony VO-1600 (discontinued), the Panasonic NV-2125, and the JVC CR-6100U and CR-6300U VCRs. With these systems simply insert the cassette, tune in the correct channel, set the INPUT SELECTOR on the VCR to TV, put the VCR in the record mode, and preset the timer for the correct time. Recording will take place automatically.

JVC—CR-6100U and CR-6300U

The clocks on the timer must be set accurately if you don't want to miss the first part of a program or run out of tape too soon. The JVC timer runs on batteries and is quite noisy. Also, it is difficult to set it accurately to + or - 2 to 5 minutes. The digital clocks in other timer-tuner systems have a greater accuracy and are easier to set.

Off-The-Air Recording Hints

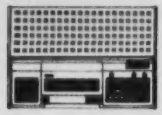
Recording by the timer method tapes the commercials along with the program which is certainly not desirable. By stopping the VCR or placing it in the PAUSE mode during commercials, they can be eliminated. Unfortunately, decommercialized 90 minute TV programs will still not quite fit on one 60 minute cassette. Since it's a drag having to use a 60 and a 30 minute cassette for a 90 minute program, the extended play 90 minute cassette might be the way to go. Also, with the single 90 minute cassette, a 90 minute TV program could be recorded unattended by the automatic timer-tuner.



JVC Timer/Clock

Erasing

In RECord mode, the erase head is energized, automatically erasing the previous material on the tape. If you want to erase only a portion of the tape without adding a new picture and sound, simply disconnect all inputs and run the tape in record mode. Be sure to make sure the red safety button on the bottom of the cassette is in place.



Procedure for Recording from a Camera Source

Step 1 Properly connect the camera, the microphones, and the TV receiver to the videocassette recorder.

Step 2 Press the POWER button and the lamp will light.

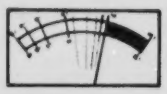
Step 3 Insert the cassette, making sure the red safety button is in place on the bottom of the cassette.

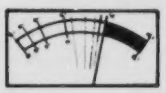
Step 4 Set the VCR INPUT SELECTOR switch for the proper input.

Step 5 Press the RECord button to monitor the picture and the sound. The recording lamp will light, and the picture and sound should come through the monitor or the TV set (E to E mode).

Step 6 Adjust the AUDIO INPUT SELECTOR on the VCR (MIX is best) and select MANUAL or LIMITER control of sound. Set the audio controls for the proper levels. *See Audio Notes.*

Setting Correct Sound Levels—Turn off the limiter. The meters should swing up to but not beyond the red zone level. Turn the limiter back on. Distortion on peak sounds should be prevented by the limiter.

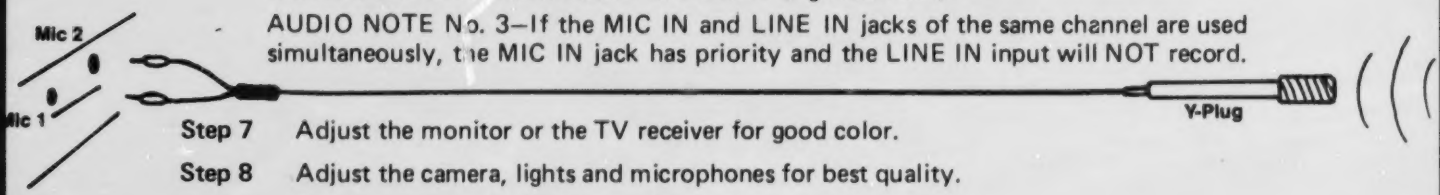




AUDIO NOTE No. 1—If using only 1 microphone, only one channel will activate. Be sure to plug the mic in the proper channel, because you can only dub over the sound on the L (left) CHANNEL or CHANNEL NO. 1. So, if you want to keep the original sound and add a second track later, be sure you record the first sound on TRACK NO. 2. To avoid confusion, buy a Y-PLUG that allows you to feed *both* channels simultaneously. This eliminates *tons* of problems later. If only one microphone input is used, turn off the control of the other sound input to eliminate extraneous noises.

AUDIO NOTE No. 2—When you use the TV 8-Pin plug with a video monitor, the sound will be recorded on audio track NO. 2 ONLY (right channel).

AUDIO NOTE No. 3—If the MIC IN and LINE IN jacks of the same channel are used simultaneously, the MIC IN jack has priority and the LINE IN input will NOT record.



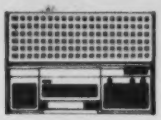
Step 7 Adjust the monitor or the TV receiver for good color.

Step 8 Adjust the camera, lights and microphones for best quality.

Step 9 Set the VCR to 000 by pressing the reset button.

Step 10 Press the RECord and FWD buttons simultaneously, the recording will start, and the automatic controls will take over. Be sure to watch the audio levels if using the manual audio controls.

Step 11 The machine will automatically stop at the end of the tape, but everything can be halted momentarily by pressing the PAUSE button, even when the machine is in the RECORD mode. The machine will continue in the RECORD mode again when the PAUSE button is pushed a second time.



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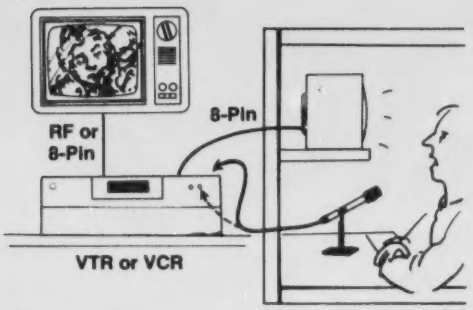
AUDIO DUBBING

Audio dubbing allows new sound to be added to a previously recorded tape. However, sound can only be added on Channel No. 1 (the left channel). No dubbing will take place if the sound source is connected to Channel No. 2 (the right channel). This seems backwards, doesn't it? But that's the way they did it. You could record voice on the first channel (CH-2) when you shoot, and add music later on the dub channel (CH-1). Then play back the tape in the MIX mode.



Audio Dubbing Procedure

Step 1 Connect proper sound source to VCR.

Step 2 Turn everything *ON*, and insert the videocassette. Make sure the red safety button is in the cassette.

Step 3 Set the VCR INPUT SELECTOR to LINE.

Step 4 Press the RECord or DUB/CH-1 button and check sound level.

Step 5 Check and adjust the sound level and select either MANUAL control or LIMITER control.

Step 6 Press the STOP button.

Step 7 Start the tape playing by activating the FWD button.

Step 8 Stop the tape where the new audio insertion is to start. Press the PAUSE button to stop the tape. Now press the DUB/CH-1 button. The machine is ready to start recording new sound.

Step 9 Press the PAUSE button again and the tape will start recording. New sound will begin recording.

CAUTION: Make sure you don't push REC and FWD accidently at once as this will erase everything.

VIDEOCASSETTE EDITING

JVC CR-6100 and CR-6300 VCRs

A rough edit or "crash" edit feature on these machines allows you to place the machine in full video and audio recording mode while the machine is running. Although not an extremely clean edit, it is adequate for certain purposes.

Electronic Editing

Recommended for this purpose are the Sony VO-2800, VO-2850, VO-2860, and the JVC CR-8300U and the Panasonic NV-9500. These VCRs are CAPSTAN SERVO editors and can be used to make perfect edits.

Editing Procedure—Manual Backspacing

Step 1 Connect the editing VCR to an input source—camera, VTR, or monitor/receiver.

Step 2 Turn everything ON.

Step 3 Insert the cassette.

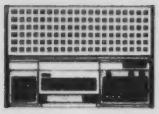
Step 4 Place the VCR in the REC (or E to E mode) and adjust the cameras, microphones, and VCR for the best sound and picture.

Step 5 Rewind the tape to a point *before* the new scene is to be added. Note the digit counter number where the new scene is to begin.

Step 6 Play back the tape and push the EDIT button when the new scene is to begin.

Step 7 Stop the tape at the end of the scene.

NOTE: The old scene and sound will be erased when the new scene begins.



How Videocassette Editing Works

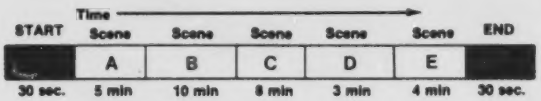
Editing presents special problems for videocassettes. Rapid locating of specific points on the tape and precisely cueing scenes to be edited is much more difficult with VCRs than with reel-to-reel machines. Special designs for editing VCRs had to be developed; in particular, a method of fast searching that did not require the tape to be dethreaded every time the machine changed modes.

Precise cueing of a VCR manually is almost impossible, so electronic controllers were developed that can automatically cue each VCR to the precise point for an edit. Then, on command, the machines start up and make the edit at the operator selected point.

Video editing essentially involves copying out the best segments of your master tapes. Thus you always need 2 VCRs to edit—one to play back and one to record. The original tapes are not cut as in film because this would destroy the tape. Rather, the scenes are assembled sequentially on a new blank tape which is placed on a second VCR. The EDITED MASTER, as the new composite tape is called, is a SECOND GENERATION tape. Probably that tape will again be copied for distribution, and these copies will then become THIRD GENERATION tapes.

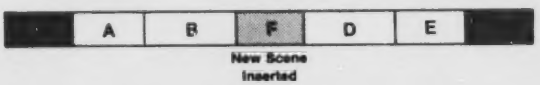
Basic Editing Methods

The basic method of editing is called ASSEMBLY or ASSEMBLE EDITING which is just the simple linear assembly of sequences. For example, segment A is followed by segment B which is followed by segment C and so on. An assemble edited tape might look like this:



Assemble Editing

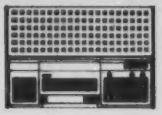
The other process of editing is called the INSERT EDITING method which allows scenes to be added to an assemble edited tape. Only sophisticated electronic editors can do this, though.



Insert Editing

Both the picture and the sound are usually edited simultaneously, but new sound can be added later to the tape by using the AUDIO DUB feature on most VCRs. Also, good electronic editors allow picture and sound to be edited separately in all kinds of combinations.

Panasonic NV-9500/NV-950 Videocassette Editing System



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Basic Videocassette Controller Editing Systems

There are several basic non-computerized automatic editing systems which include the editing controller and 2 VCRs. All of the basic systems allow you to search for your scenes in a special SEARCH mode at 1/5th the normal tape speed. When the scenes are located, the edit points are logged into memory; each tape is automatically PRE-ROLLED (backed up), and then both VCRs start, roll, and the editing VCR makes the edit automatically.

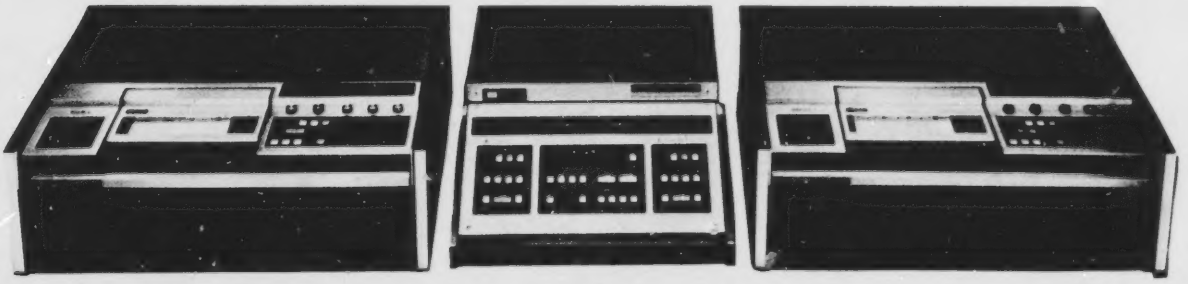
The machines keep track of the edit points on the tape by counting the control track pulses. This method is not as accurate as the time code system, but it works quite well for most purposes.

Panasonic NV-9500/NV-A950—The Panasonic system does provide an edit rehearsal feature and a memory for entry and exit points for audio and video insert edits. The NV-A950 controller does not have a digital counter, however. The Panasonic VCR provides vertical sync and subcarrier inputs for use with external sync lock systems and time base correctors. A chroma adjustment is also provided. In addition, the Panasonic system allows use of a less costly non-editing VCR (the NV-9200), as the playback machine, a factor which lowers the overall cost of the system ($9,500).

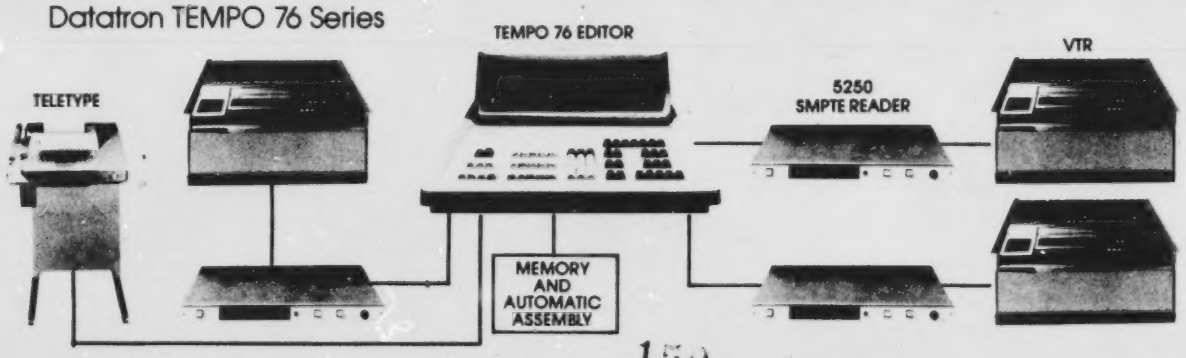
Sony VO-2860/RM-430—This second generation basic editing system ($13,750) automatically edits and incorporates special TBC and dubbing connectors which permit high quality duplication to 5 generations. The RM-430 programmer provides dual digital tape counters, forward and reverse play at normal and 1/20th speeds, edit preview, edit point memory and accepts Betamax or U-Matic feed machines.

Most U-Matic editing systems require the use of two identical editing recorders. Since you can only use one player and one recorder at a time, this seems an unnecessary expense. Like Panasonic, though, Sony has a capstan-servo player-only machine, called the VP-2260, which can be used in conjunction with a VO-2860 recorder and the RM-430 editing controller. The VP-2260, like the VO-2860, has the built-in special dubbing mode output and includes external sync and SC (subcarrier) connectors for operation with a time base corrector.

Sony BVU-200/BVE-500—The Sony BVU system is a highly sophisticated and accurate editing system designed specifically for use by TV broadcasters. Priced at $23,000, this system includes many advanced features.



Sony BVU-200/BVE-500 Broadcast Editing System



JVC CR-8500 LU/RM-85U Videocassette Editing System

JVC CR-8500LU/RM-85U – Although mainly intended for broadcasters, this system incorporates many advanced features such as high speed search (10 times normal speed), automatic search in both forward and reverse modes, and accuracy to ± 2 frames. Search speeds of 2X, 1/5th and 1/20th normal speed with picture and sound are also selectable. The logic in the controller is easy to use, once understood, and the tape is automatically pre-rolled at the completion of each edit, thus saving time preparing for the next edit. The system is priced at $16,000, and replaces an earlier version, the CR-8300U/RM-83U.

Remote Controls

Most VCRs have the ability to operate with optional remote control units. Use the RM-420 remote control unit with the Sony Type II series VCRs. The RM-420 also contains the logic circuitry for the control functions.

Advanced Videocassette Editing Systems

There are other systems that can get quite expensive and very sophisticated. The computer systems such as the DATATRON, or CMX systems can handle 3 or more VCRs and do "A" and "B" roll editing with dissolves, wipes, and all kinds of special effects.

Automatic Replay Adaptor–The ARP-2

Many VCRs have an automatic repeat mode built into the machine, but some do not. A special transistorized plug can be purchased from the *Comprehensive Video Supply Corporation* that attaches directly to the remote control receptacle on all Sony Type II VCRs. This adaptor permits on-going continuous and automatic replaying and rewinding of the tape without operator intervention. This feature would be very useful for sales presentation or information centers such as doctors' offices, hotel libraries or video art exhibitions in museums, or in store front display areas. The plug is called the ARP-2 and costs $49.95. Many video dealers may also carry it.

VCR Uses

¾-inch VCRs are used for all kinds of productions and applications. Sophisticated systems are used for fine quality studio mastering, editing and dubbing, while portable U-Matics are used every day for TV news and documentary shooting. VCRs are automated to play back tapes in juke-box like systems, and they make ideal learning center machines which can be operated manually or by remote control. Time lapse and 2-hour non-compatible U-Matics are available from Sony, and large programming libraries are available covering a wide range of subject matter. *See Appendix–VCR Program Sources.*

½-INCH VIDEOCASSETTE SYSTEMS

½-inch Videocassette Systems

Similar in design to the ¾-inch U-Matic videocassette systems, a whole range of ½-inch videocassette systems are also available, some models designed specifically for educational/industrial use. The ½-inch format, though, is divided into several incompatible formats—Betamax 1-hour, Beta 2-hour and VHS 2/4-hour. The ¾-inch VCRs do produce better picture and sound quality and have greater editing flexibility, but the ½-inch format excels as a simple low-cost basic program recording and playback medium with a wide range of very useful features.

Industrial vs. Home ½-inch Systems

The ½-inch VCR formats such as Betamax and VHS were originally designed for home use, but the significantly lower costs of ½-inch VCR made this new format very attractive to educational/industrial users also.

Sanyo was really the first manufacturer to introduce a ½-inch VCR designed for educational/industrial and home use—the V-Cord II, but it was a special Sanyo standard and too expensive, heavy, and tape costs were too high to really become a big seller relative to the Betamax and VHS systems.

Sony and Panasonic soon introduced systems based on the Betamax and VHS format, and educational/industrial users then really became enthusiastic about ½-inch VCRs. Sony created the 100, 200 and 300 series 1-hour only Betamax format VCRs, and Panasonic introduced the 2-hour only NV-8250 and NV-8300 2-hour only VHS VCRs.

Next came the variable speed NV-8160 and NV-8310 and the 2 and 4-hour NV-1000A. A portable VHS industrial VCR, called the NV-8400, coupled with the WV-3300 portable color camera, makes on-location shooting easy and provides great system versatility. Unfortunately, editing systems in the VHS format are not yet available although they certainly can be expected soon.

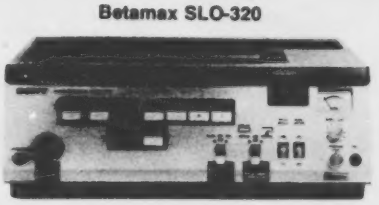
These industrial ½-inch systems are designed for heavy use and most feature the standard industrial 8-Pin, BNC, UHF, and RCA/phono connectors. The 300 series Betamax system includes 2 push-button solenoid controlled VCRs and a portable VCR. Costs of the industrial VCRs are slightly higher than the home VCRs.

Other "Industrially Usable" VCRs

Just because a VCR is not labled specifically an industrial VCR does not mean it cannot be used as such. Industrial users do place heavier demands on VCRs than the normal home user and often require sophisticated features such as remote control, automatic repeat and rewind, memory access, and extensive editing and dubbing of tapes. Standard industrial connectors and high picture quality are prime considerations for industrial users. Length of playing time, such as 4-hours, is not. Improved picture quality is definitely more important than long playing or recording times. Also, industrial users generally do not need a TV tuner on a VCR.

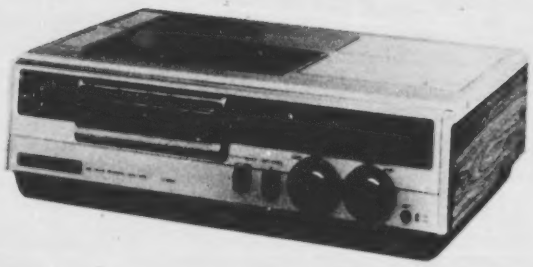
Nevertheless, there are a number of VCRs that provide great potential for the industrial system, even if it's already primarily ¾-inch, or ½-inch reel-to-reel. Obviously, ½-inch VCR is an ideal and inexpensive tape distribution and playback format. Specific units like the JVC HR-3600 with its double-speed video and audio playback and remote pause/freeze frame control make good potential professional editing VCRs and fast tape review machines. The JVC HR-4100 VHS portable coupled with a G-Series color camera makes a dynamite way to record color on location easily and inexpensively. With the proper plug adapters, both the camera and the VCR will easily interface with other types of video equipment.

Betamax SLO-320

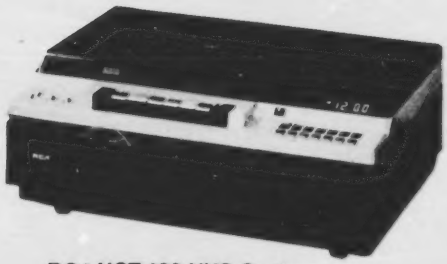


Industrial ½-Inch VCRs

Panasonic NV-8300



Hitachi VTC-4200



RCA VCT-400 VHS System

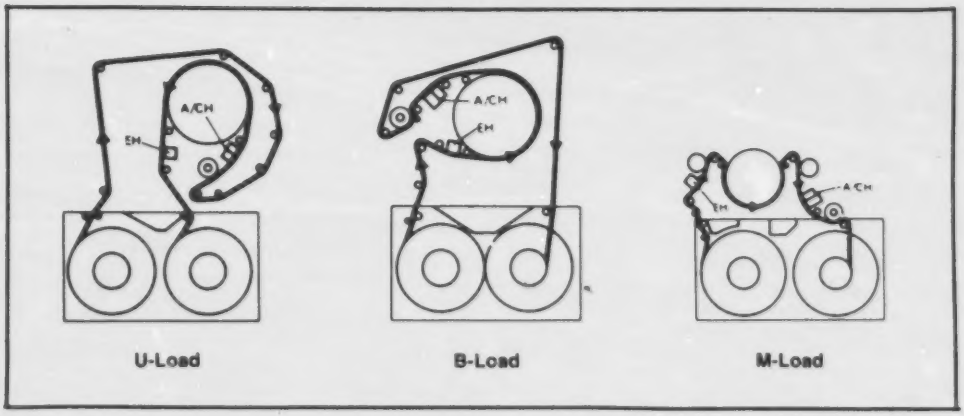
The Hitachi VTC-4200 VCR, a 2 and 4-hour VHS machine, has very good specs and would be a good machine to utilize also, except it doesn't have an audio dub feature, which could be a real handicap to educational/industrial users. For automatically recording programs from a cable TV or closed circuit RF system or an off-air broadcasting system, the RCA VCT-400 or any other programmable VCR would be a valuable device. As more sophisticated home VCRs are produced for the home, the educational/industrial user will reap the benefits.

½-Inch VCR Internal Design

Azimuth Recording Process A big innovation in the ½-inch VCR has been the elimination of the guardbands by using the Azimuth recording process (see p. 67) for all VHS and Beta ½-inch VCRs. The Azimuth design allows much more information to be placed on the tape, thus the ½-inch VCRs use only a quarter of the amount of tape required by a U-Matic format cassette.

Cassette Loading Design Another innovation is the different loading designs of the various VCRs. The U-Matic machines use a very long loading path called a U-LOAD design, whereas the Betamax and Beta VCRs use a shorter B-LOAD design, and the VHS system uses the shortest M-LOAD design.

Loading Design



U-Load B-Load M-Load

On the other hand, the tape tension is greatest in the M-load system when it is threaded and is playing or recording. Hence, the tape is subjected to more overall wear. Excessive tape tension can eventually stretch the tape causing problems with interchange. The M-load system when playing or recording exposes the tape to 1½ times the tension as the B-load system. Older ¾-inch U-Matic machines de-thread the tape completely in all modes except for RECORD and PLAY, but the long wait for the tape to thread is very annoying and makes it quite difficult to locate precise segments of the tape. Newer U-Matics only partially de-thread the tape and just retract the tape away from the video heads during FAST FORWARD or REWIND mode to prevent unnecessary head and tape wear.

There are advantages and disadvantages to each system. The shorter tape path such as the VHS M-load means shorter threading time and allows the VCR to quickly retract the tape into the cassette each time the STOP button is pressed. When the tape is returned to the cassette, there is no head-to-tape contact, and thus minimal wear on the video heads and tape. With the B-load system, the tape is threaded as soon as the cassette is inserted and remains so even when the machine is turned off. This produces some extra tension on the tape, especially when the tape is rewound or fast forwarded.

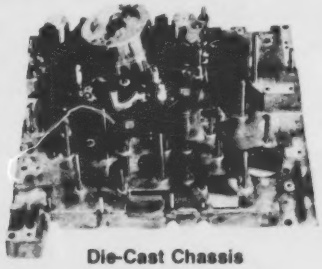
Since the M-loading system normally returns the tape to the cassette when changing modes, it made it difficult to edit or find an exact spot on the tape. This is why the first VHS machines did not offer a still frame feature. Now, however, a number of VHS machines, such as the JVC HR-3600 and Panasonic NV-8160 and NV-8310, not only provide still frame, but also variable speed playback of video and audio as well. However, the tape is subjected to greater stress when it is moved at these different speeds while it is threaded against the heads. Since the B-load VCRs stay threaded normally and are designed for the tension, a still frame mode is easier to provide and creates less wear on the tape.

Speed/Tape Factors Another difference between the Beta and VHS formats is the speed/tape relationship. Unfortunately, the Beta format was designed for a 1-hour only recording time, and Sony consequently made the cassette "too small." The only way Sony could extend the playing time to compete with the VHS 2-hour systems was to halve the tape speed. This necessitated a reduction in picture quality and a less optimum head design. Since the VHS system was originally designed for 2 hours, and thus uses a larger cassette with slightly more tape in it, most VHS systems can record for 2 or 4 hours using only slightly more tape than the Beta system. The VHS system moves the tape at 3.34 cm/sec (1.31ips) in the 2-hour mode as compared with the Betamax speed of 4 cm/sec (1.96 ips) in the 1-hour mode.

Die Cast Chassis The Matsushita built VHS systems (all except JVC and Hitachi VTC-4200) utilize a rugged DIE CAST CHASSIS which means that all the critical internal components are mounted into a one piece annealed aluminum die-cast chassis, thereby creating a VCR that is strong, rugged and lightweight.

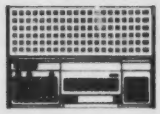
Direct Drive And Capstan Servos Most Betamax and VHS VCRs use DIRECT DRIVE (beltless) motors in order to minimize mechanical jitter and optimize picture stability. DC motors are used so the speed of the VCR can be kept independent of the power line frequency (50 or 60 Hz). This means the systems can be used with either 50 Hz or 60 Hz power systems.

Machines like the Panasonic industrial VHS VCRs use a direct drive video head cylinder, and Sony 300 Series VCRs use a direct drive capstan servo. Capstan servos are necessary for ½-inch VCRs because of their extremely slow tape speeds which makes them very susceptible to mechanical and electronic error.



Die-Cast Chassis

Direct Drive
Head Cylinder Motor

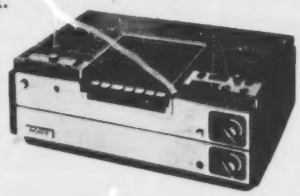


Popular Industrial ½-Inch VCR Models

Betamax Industrial VCRs

The original industrial Betamax was the slightly modified home Betamax model which industrially was termed the SLO-260 recorder and the SLP-100 player. The SLO-260 added a still frame capability, audio dub, video and audio input and output connectors and an audio level meter and manual override. Because it was only a "second generation" Betamax VCR, its picture quality is less that the "third generation" Betamax 300 series machines.

The 300 series Betamax machines were a big step forward and have always represented the state-of-the-art for some time after their introduction. The SLP-300 player and SLO-320 recorder/player featured the first low-cost AUTOMATIC SEARCH CONTROL. With the original unit, called the RM-300 AUTO SEARCH CONTROL, any segment of the tape could be located rapidly and automatically by means of an electronic indexing system. The VCR does this by counting the control track pulses on the videotape, and the automatic controller serves as the indexing unit. The controller will cue up and play the desired segment automatically and precisely when the index numbers are entered into it.



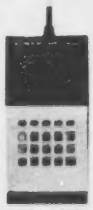
Betamax SLO-260 Recorder/Player

RM-300

Betamax SLP-300 Player

Memory Access Controllers

RX-303



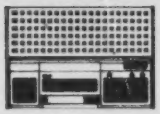
RX-353

More sophisticated Betamax models, such as the SLP-303 player and the SLO-323 recorder/player, were later introduced with two far more sophisticated PROGRAMMABLE AUTO SEARCH CONTROLS, the RX-303 ($350) and the RX-353 ($400). The RX series will direct the appropriate U-Matic (VO-2611) and Betamax VCRs to remotely stop, advance, rewind, stop again and then play either at pre-selected segment demarcations or at any hour and minute of tape time selected by the operator.

Both autosearch units have memory capacity of up to 63 segments and may be programmed to recall any 8 segments in any order and programmed for repetition if desired. The RX-353 can be used to record on the tape the audio tones by which segments are demarcated as well as to recall the segments as desired individually or in any programmed sequence. The RX-303 *does not* allow for recording of programmed audio tones on the tape, so programmed operations must be manually re-entered in the programmer. Both units provide rapid access to any spot on the tape, may be programmed to search in either direction, will command the VCR to skip and review segments in the programmed sequence, can interrupt the program sequence at any time and are easy to operate once the control functions are understood.

Such remote control flexibility makes them ideal for training and instructional applications. Because the program information is stored in the form of an audio tone recorded prior to the video on the tape, existing tape libraries can be indexed with the RX-303 and RX-353. Although the RX-353 is required to record the master program sequence, duplication of programmed tapes can be accomplished with any VCR.

Betamax SLO-323 Recorder/Player



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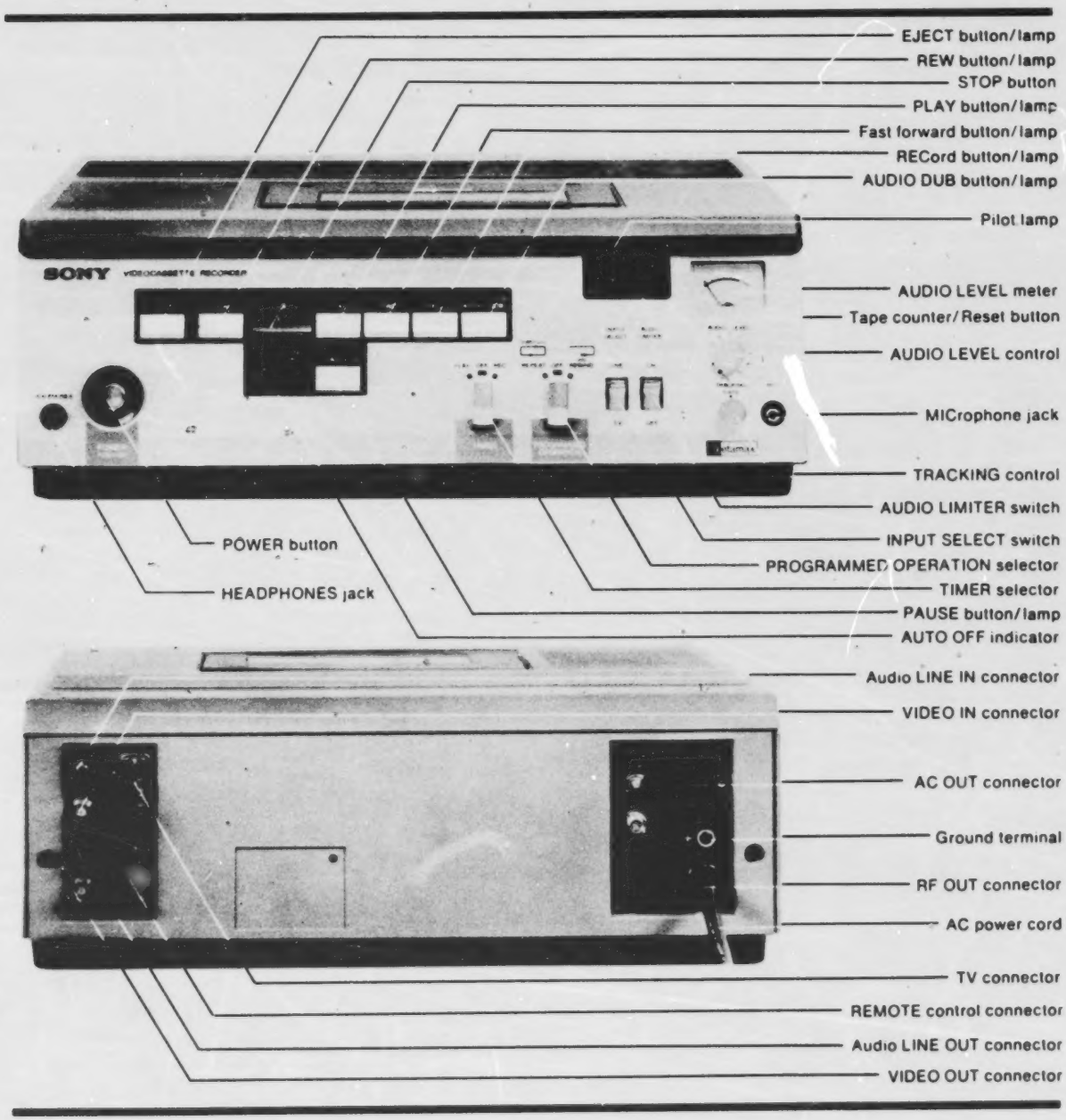
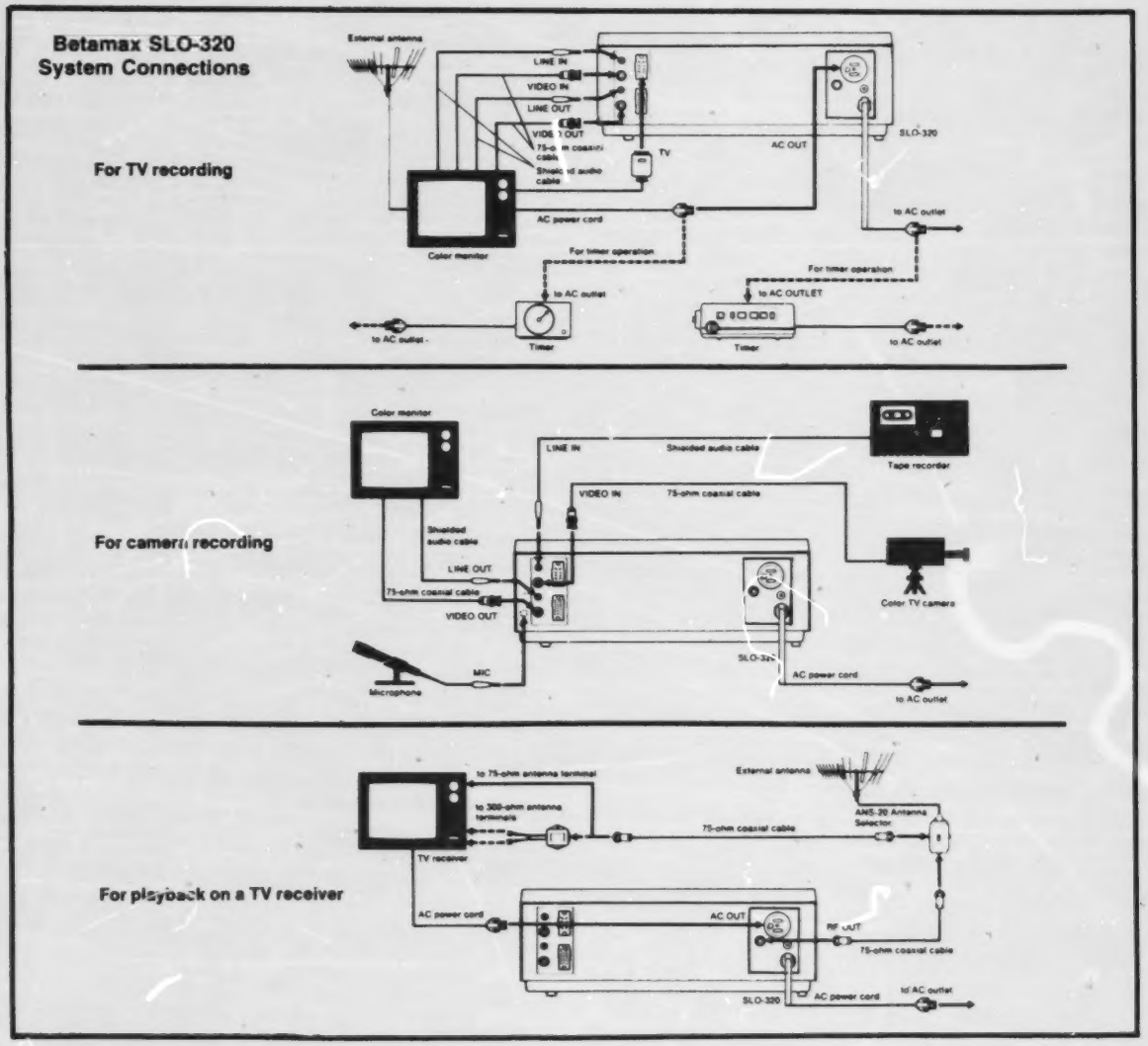
300 Series Betamax Features

The 300 series Betamax VCRs all have push-button solenoid controls containing an internal logic system which allows the operator to select any function without going to STOP mode first. All machines utilize professional BNC video connectors and RCA/phono audio connectors. Unfortunately, Sony neglected to install an 8-Pin monitor connector on the SLP-300 and the SLP-303, but both recorders have 8-Pin connectors. Both recorders (SLO-320 and SLO-323) also feature audio meters, manual controls and audio limiters. Freeze frame and auto-repeat are provided on all VCRs, and all machines may be interfaced with the RM-410 and RM-420 for remote control operation and the RM-400 and RM-430 electronic editing controllers for editing with the appropriate Sony ¾-inch editing VCRs.



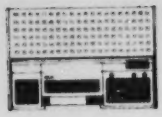


Unique features of the SLP-303 and SLO-323 are dual audio tracks for stereo sound, a high-speed picture search function called BETA-SCAN, which allows programs to be played at speeds of up to 15 times normal speed with coherent picture, extensive program address functions, noiseless still-frame, automatic frame advance, improved editing functions and variable speed play.

The SLO-323 will provide an edit preview function when used with the RM-430 edit controller, and picture disturbance at the edit point has been minimized. Direct-drive on both the head drum and capstan are used to maintain precise tape alignment. Since the tape stays in contact with the video heads during fast forward and rewind functions, the picture may be viewed at all times — a useful feature for high-speed search. Good slow motion playback at 1/10th normal speed is also possible, and noise reduction circuitry is provided on the audio tracks. Price of the SLO-323 is $1,600 without the Auto-Search controller.

Betamax Editing

Because the 300 series machines are solenoid controlled, they lend themselves easily to editing controllers such as the Sony RM-430. Thus, editing can be accomplished between a ½-inch player and recorder VCR or ½-inch VCR and the Sony VO-2850 or VO-2860 ¾-inch VCRs. Editing is best when using the newer SLO-323 with a VO-2860. Eventually, Sony will no doubt introduce a true Betamax editing machine, probably by late 1980 or so.



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½-Inch Betamax to ¾-Inch U-Matic Editing with RM-430 Auto-Controller

SLO-340

The unique SLO-340 was the first portable Betamax recorder. It is a compact 20 lb. unit that will operate for up to 90 minutes on one fully charged battery. The machine will record in either black and white or color. Of course it holds only one 60 minute tape at a time, so you would have to change tapes after 60 minutes of continuous recording. You can also easily change rechargeable battery packs for greater recording time. The cassette tapes are completely interchangeable with any other 1-hour Betamax VCR.

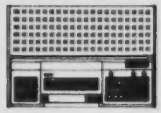
The SLO-340 contains a variety of nice features. Like most portable VTRs, the recorder may be powered by a rechargeable built-in battery pack. For this particular VCR, the battery is the BP-60 battery, which is, strangely, an optional accessory. Or, you may power the VCR with the AC-340 AC power adaptor (included) or with the DCC-3000 car battery adaptor (optional).

Also, the SLO-340 is a one-button operation. An automatic interlock prevents damage to the machine if you try to press the wrong button. Automatic circuitry maintains the proper audio and video levels to assure optimum recording. An audio dub feature is provided so you can add a narration later, and the VCR includes a built-in RF Converter so you can play back the picture and sound through any conventional TV set.

Betamax SLO-340

The VCR starts and stops rapidly when you activate the on/off trigger switch on the camera, and a clean "edit" is achievable about 60% of the time. The SLO-340 is not an editing machine with a built-in backspacer comparable to true editors like the JVC CR-4400U, Panasonic WV-9400 or Sony BVU-50 ¾-inch or Akai VT-350 ½-inch VCRs.

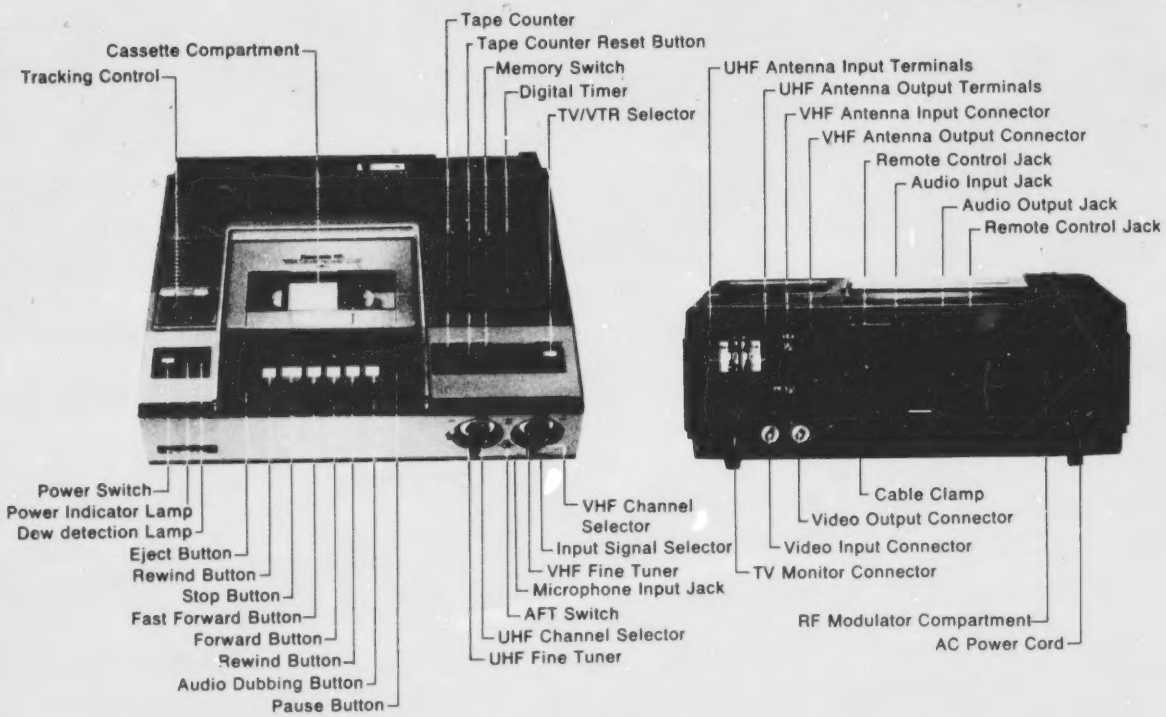
The SLO-340 will accept either a black and white or color camera. The cameras that interface most easily with it are the AVC-3450 black and white camera and the DXC-1610 color camera. The AVC-3450 weighs less and is more light sensitive than the DXC-1610; that is, it will take picture in much less light. Also, it is about one-fifth the cost of the DXC-1610.

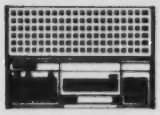


NV-8160/NV-8310/NV-1000A

Panasonic produces several 2-hour and 2/4-hour industrial VHS systems referred to as the OMNIVISION II series. The original player and recorder were the NV-8150 and NV-8300 respectively. Next, came the NV-8160 player and the NV-8310 recorder, whose main features are a new timer that turns the VCR off automatically, a PAUSE/still frame mode which turns off automatically after 5 minutes to prevent tape damage, still frame compensation circuitry which minimizes snowy video noise in the still frame mode, a still frame advance button, switchable channel 3 or channel 4 RF unit and an adjustable speed control which varies the speed of the tape playback in the PAUSE mode from 0 to 1.5 times regular speed. A special 2X speed knob provides even faster search of the video and audio. A 2 and 4-hour VCR, the NV-1000A is also available although it does not have the variable speed features of the NV-8160 and NV-8310.

NV-8300 Omnivision II RECORDER WITH VHF/UHF TUNERS





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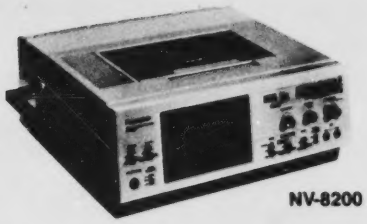
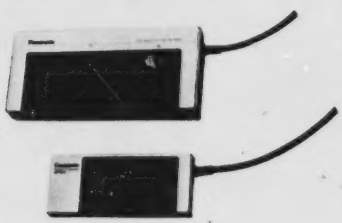
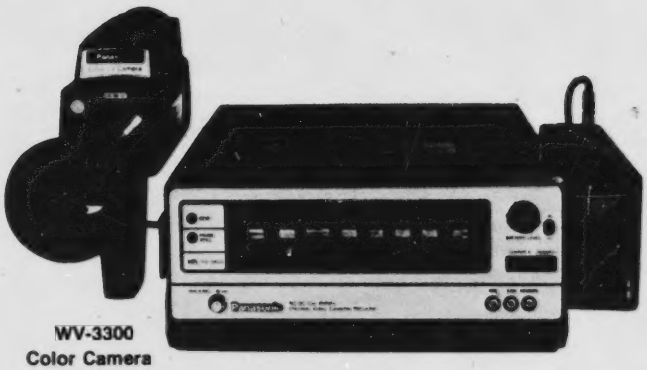


NV-8200





WV-3300
Color Camera

NV-8400
Portable VCR

NV-8170

Panasonic NV-8170/NV-8200 VCRs

Panasonic also has logic-controlled solenoid-operated ½-inch VCRs which can utilize random access AUTO-SEARCH controllers. The NV-8170 player and NV-8200 recorder/player are 2-hour industrial VHS VCRs which incorporate MEMORY REWIND or auto-rewind to a specific spot on the tape, AUTOMATIC REPEAT and an AUTOMATIC REWIND from the end of the tape. The VCRs feature quartz-locked direct-drive video head cylinder and capstan-drive, and a three-motor transport system for good tape stability and interchangeability.

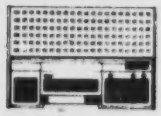
These Panasonic machines were the first ½-inch VCRs to offer dual audio tracks for stereo or bilingual recording, a still-frame mode with AUTOMATIC STILL-FRAME COMPENSATOR (ASC) for clear noise-free picture, still-frame advance, variable speed playback from 0.2 to 1.5 times normal speed and double speed playback. These Panasonic VCRs will interface with the Panasonic ¾-inch NV-9200A or NV-9500A industrial editing VCRs when used with the proper editing controller and interface adapters.

NV-8400 Portable Panasonic VHS VCR

A portable, lightweight (19.6 lbs.) and battery operated VHS VCR, the NV-8400 provides a good way to shoot on location. Like the other Omnivision II VCRs, the NV-8400 is a 2-hour machine with good picture quality for ½-inch. The VCR draws only 9.5 watts and will operate on its own internal rechargeable battery, a 120 volt AC outlet with the AC adaptor/battery charger NV-B51 (included) or any other 12 volt external power source. It has a PAUSE/still frame mode with automatic still frame compensation. The PAUSE control can be operated from the unit or remotely with the NV-A181 remote control switch. Included also is an AUDIO DUB switch, internal switchable RF unit, memory rewind and a safety shut-off switch if the tape jams. Price is around $1,300.

Panasonic Color Cameras

Panasonic also has available two very compact and light sensitive color cameras—the basic optical-viewfinder, fixed focus lens WV-3310, intended for use with the AC operated VCRs such as the NV-8310 and NV-1000A, and the WV-3300 battery operated camera with electronic viewfinder and 6:1 zoom lens designed for use with the NV-8400 portable ½-inch VCR or the NV-9400 portable ¾-inch recorder. The camera heads weigh only 4-6 lbs., and the external CCU weighs only 2 lbs. Both cameras have built-in condenser microphones and a wide range of accessories including a wide angle lens. Prices are $900 to $1,400. A newer model WV-3320 adds an automatic iris lens.



Industrial Use Of Home ½-Inch VCRs

As we mentioned earlier, any of the other ½-inch VCRs can be integrated into your system without too much problem. The major nuisance though, will be the home VCR's lack of standard industrial closed circuit input/output connectors such as the 8-Pin, BNC, UHF and RCA/phono plugs. A good stock of adapters will make interfacing less troublesome.

Overview

Because ½-inch VCR is so new and moving so fast, long term experience is hard to come by. Some observations by myself and other veteran video users may be helpful to your hardware decisions.

Features Beta units, both home and industrial, come with built-in RF units. All home VHS systems have built-in RF units also, but the Panasonic NV-8150 and NV-8300 industrial VCRs only offer them as options.

All recording industrial Beta units offer a freeze frame capability, VU meters and manual audio level control. Most VHS units do not. The Beta 2 mode, especially on the newer type units, is very good because of additional noise reduction circuitry, and in some opinions is very close, equals and in some instances, is better than the VHS 2-hour mode. It is certainly better than the VHS 4-hour mode. The Beta 1-hour mode is often considered superior to the 2-hour VHS mode. Most Beta home machines *do not* have the audio dub feature whereas almost all VHS machines do. It's difficult to say anything negative about the Sony SLO-320, and it receives nearly unanimous praise from most users as a well designed, extremely flexible and high quality machine.

Interchangeability within the format Sony Betamax and Beta-2 VCRs get very high marks in this category. Tapes are nearly always perfectly interchangeable between any Beta machines *in the same speed mode.* A good measure of tape interchangeability is whether or not the TRACKING control must be adjusted to play back a tape made on another machine. Beta tapes almost never need any adjustment of tracking, and the picture is clear and solid when played back on a different Beta machine. This is not so true with VHS machines. Often the TRACKING control must be adjusted even with the 2-hour mode tapes. Interchangeability with the 4-hour tapes often poses greater difficulty. There is also a tape problem if you try to use the VHS 2-hour only tapes designed for the JVC, MGA and Hitachi VTC-3000 VCRs on a 4-hour machine in the 4-hour recording mode. Also, some VHS cassettes are not as well designed as others, and jam ups and broken cassettes will occur. The Beta cassettes have their problems too, but Sony is very good about exchanges.

The VHS format, though, offers an incredible range of exciting features—portability, variable speeds, frame-by-frame search (JVC HR-3600), 4-hour capability, programmable recording and much more to come.

It's no easy choice between the formats even for veteran video users. Both have their advantages and disadvantages. Try to pick the format that serves your production needs best and fits within your budget.

Next, we will explore the exciting potential of portable video systems, and how "you can take it with you."

CARE OF VIDEOCASSETTE RECORDERS

- Always keep dust covers on the machines.
- Do not place drinks, ashtrays or any other items on top of the VCR.
- Keep VCRs well ventilated and do not expose machines (or people) to cigarette smoke.
- Operate only on 120 V, 60 Hz. Use the special foreign model videocassette units for other countries not on the American NTSC standard.
- Do not subject the machines (or people) to unnecessary shock.
- Never operate a VCR immediately after transporting it from an extremely cold to a warm environment.
- Operate the machine in the horizontal position only.
- Keep machines and tape away from strong magnetic fields, high temperatures, dust and moisture. Protect the machine from ocean air, and clean regularly.
- Allow tapes to become acclimated to the room temperature before using.
- Always rewind the tapes completely after playing. *See Videocassette Winding Problems—Chapter 14—Maintenance.*

Chapter 12
The Video Portapak
How To Take It With You

"The unseen dark plays on his flute
and the rhythm of light
eddies into stars and suns
into thoughts and dreams."

Rabindranath Tagore

Portable video is portable perception. With our electronic eyes and ears we can observe an event from a distance or merge wholly within it, creating a moving kaleidoscope of vision and sound.

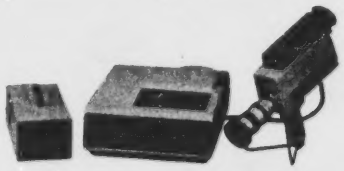
A complete mobile sensory system, the video portapak can go with us, see all that is happening and remember everything (assuming the tape is properly threaded). We can pick and choose from an infinite variety of camera angles and live dialog and then blend these components with the natural music of the environment. We can become artists who paint electronic pictures of life, capturing its spontaneity, easily and efficiently.

Unlike the awkward studio camera and VTR which require the construction of artificial environments, the portable video system can seek out life where it happens and record it on tape, processing it all through the unique filter of the individual cameraperson/director. We have here an enormously powerful tool of self-expression and communication. *How* you see is what you get, and thus you determine through your own eyes how others will see events.

The portable video system represents the essence of decentralized media. One person now becomes an entire TV studio, capable of producing a powerful statement about himself/herself or communicating a sense of people, places, and events to a planet full of potential listeners. How you use the tools determines the power and impact of your message. As with any artistic endeavor, some technical proficiency in the craft will greatly assist the outward flow of inner creativity.

What's A Portapak?

Getting down to earth, the portapak is a portable or mobile video system that is completely self-contained, battery powered and can be carried and controlled by one (strong) person. This type of video system is the most practical way to take video out of the artificial studio environment. The video portapak is definitely one of the most ingenious and exciting developments of modern technology. Its significance and impact on society and the media is only just beginning to be felt. Television, the real mother of so many millions of young minds, is now being shaped and directed by new hands. The cycle is complete. Society will continue to be affected by television. The video portapak has made this inevitable.



Panasonic Portable Video System

These portable video systems or PORTAPAKS as they are usually called, are marketed by several manufacturers. Sony's trademarked name for the b&w model is the VIDEOROVER, and the color videocassette version is called the VIDEORANGER. The Sony portapaks are very popular machines, have a good resale value and are very dependable if taken care of. They are capable of reproducing good picture and sound quality.

A portapak consists of a portable video camera with a built-in microphone and electronic viewfinder, a VTR and a monitor all engineered into a battery-powered unit that weighs from 15 to 50 pounds and records up to 30 minutes of videotape. The VTR fits in a special carrying case which goes over the shoulder, and unlike the color cameras, the b&w cameras are small and light enough to be hand held for long periods of time. The built-in microphone records the sound automatically. Portapaks combine relatively high technical quality with excellent freedom of movement. An individual can now capture life in all its spontaneity, easily and completely and replay the results immediately. The streets now become the studio!

The problem of "portable system compromise" becomes even more apparent when trying to edit and make copies later with the tapes. Some portable VTRs such as the AV-3400 and the VO-3800 simply refuse to track the tape correctly if subjected to certain spins or angles while being carried over the shoulder. If possible, treat the VTR carefully, and keep it in a horizontal position when recording.

Portapak Features:

All portapaks can work two ways—on regular 120 Volt AC power with an AC adaptor or on 12 Volt DC battery power.

·¾-Inch U-Matic Videocassette

- ·Same features of ½-inch EIAJ
- ·Stereo sound
- ·High quality color
- ·Compatible with all U-Matic VCRs
- ·Uses easy loading ¾-inch compact videocassettes
- ·Automatic assemble editing with JVC CR-4400U and Panasonic NV-9400

·½-Inch Reel-to-Reel EIAJ:

- ·Lightweight
- ·6:1 or 4:1 Zoom lens
- ·Some models color capable
- ·Still framing capability
- ·Audio dub
- ·Plays back picture through the camera viewfinder
- ·Can record and play both picture and sound from a camera or off-the-air.
- ·Plays back the picture and sound on a TV set with an optional RF adaptor
- ·Standardized — compatible with any ½-inch EIAJ reel-to-reel VTR

·½-Inch Non-EIAJ—SANYO

- ·Slow motion
- ·Cassette loading
- ·Portable and lightweight

·¼-Inch and ½-Inch AKAI

- ·Very lightweight
- ·RF adaptor optional
- ·Not standardized
- ·Some models record and play color
- ·Uses low cost ¼-inch tape or ½-inch videocassette (VT-300 only)
- ·Records picture and sound and plays the picture back through the camera viewfinder

Technical Limitations of Portapaks

Usually, you have to pay a price in performance when attempting to make videotape recorders smaller. The elements that take up the most room and weigh the most such as the motors, drive systems and fly wheels, largely determine the VTR recording quality. In video, proper tape speed, accurate tape scanning, and motor drive system mechanics are crucial to the quality of the tape. These factors must be maintained within extremely narrow parameters if the tape is to be played back or interchanged with other VTRs successfully. If motors must be made smaller or eliminated, and heavy flywheels that give the tape stability must be reduced in size, the overall recording quality can become considerably compromised. And that's what portapaks are—a compromise between the picture quality and stability of a big studio VTR, and the portability required for field recording.

Popular Portapaks

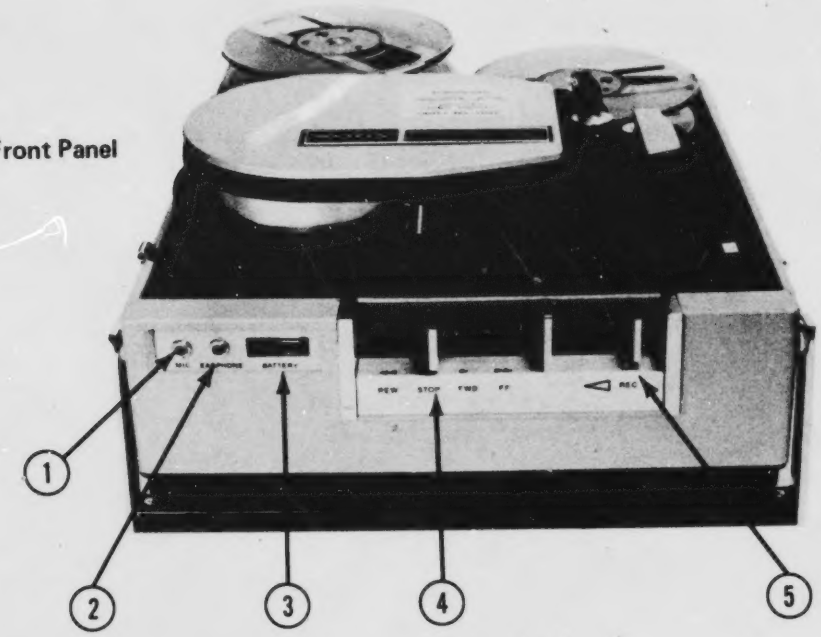
The most popular model portapak is the venerable Sony EIAJ AV/AVC-3400 b&w VTR system; next comes the Panasonic NV/WV-3082 portable system. Newer systems of the ½-inch EIAJ type portapaks include the Sony AV-8400S/AVC-3450 and the Panasonic NV/WV-3085 systems. All these are ½-inch EIAJ reel-to-reel machines and black-and-white cameras. Following the ½-inch EIAJ chapter, we will deal separately with the ¾-inch U-Matic videocassette color portable systems in the *Electronic Field Production* (EFP or ENG) Chapter. Feel free to select the information regarding the specific unit you are using.

½-INCH EIAJ REEL-TO-REEL PORTAPAKS

THE SONY AV-3400 PORTABLE VIDEO SYSTEM

The Sony AV-3400 is a black-and-white *only* ½-inch EIAJ reel-to-reel VTR. Its simplicity and reliability have made it the workhorse of nonbroadcast video.

AV-3400 Front Panel



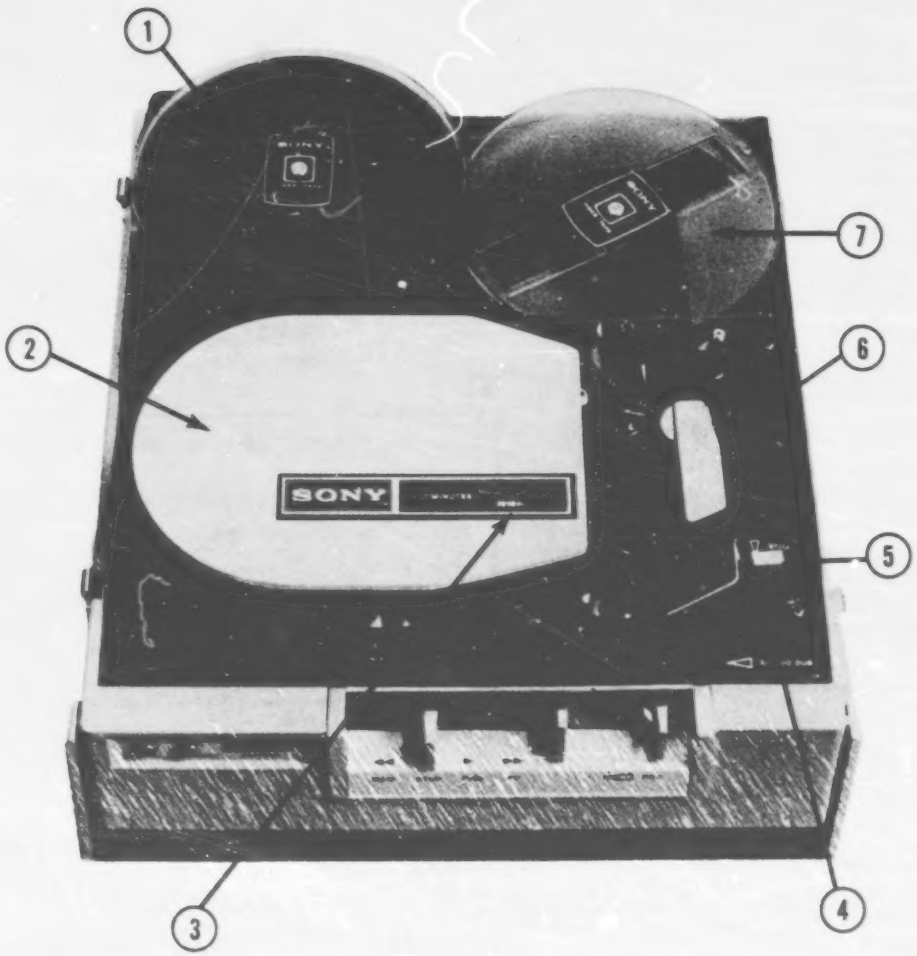
Sony AV-3400 Controls and Connections

1. EXTERNAL *MICROPHONE* INPUT—Use a low impedance (200 ohm or 600 ohm) microphone only. When the external mic (microphone) is plugged in, it cancles out the built-in mic in the camera.
2. *EARPHONE* INPUT—Allows the operator to monitor the recording and the playback of the sound. An earphone is included in the system package, but use the SENNHEISER Model HD-414 headphones for really excellent sound (about $40). The EARPHONE input also can be used as a sound output—LINE OUT, high impedance.
3. *BATTERY* CHARGE LEVEL METER—Indicates how much charge is left in the battery. *Do not use the VTR* when the needle is in the red zone.

Good Battery Condition

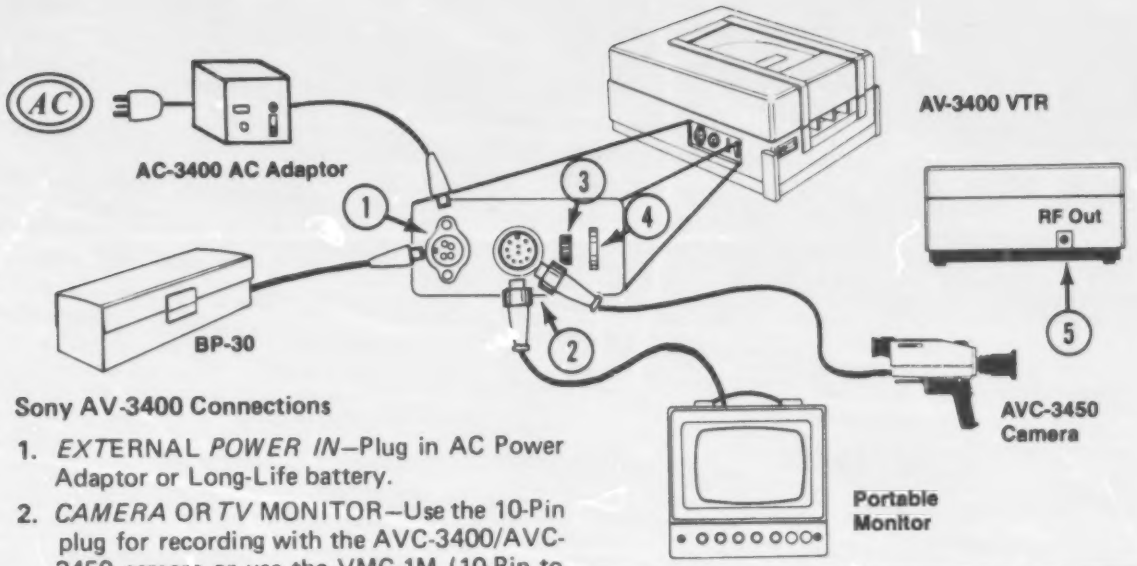
4. FUNCTION LEVER—— *REW*IND— ◀◀ rewinds the tape
   FWD (Forward ▶) use for playing or recording tape
   STOP (■) stops the tape and turns the VTR OFF
   FF (Fast Forward ▶▶) advances the tape rapidly
5. *REC*ORD LEVER—Use to put the VTR in RECORD mode or check the battery level.

Sony AV-3400 Top View



Sony AV-3400 Controls

1. SUPPLY REEL—Place a full reel of tape here.
2. ROTARY VIDEO HEADS—Do not touch while the heads are in motion.
3. TAPE *MINUTE* COUNTER AND RESET BUTTON—Set to 000 at the beginning of the tape.
4. *SOUND DUB* BUTTON—Use for adding new sound.
5. *STILL* FRAME BUTTON—Use in playback mode to display a single frame.
6. AUTO SHUT-OFF SWITCH—Turns the VTR OFF when the tape runs out.
7. TAKE-UP REEL—Place an empty reel of tape here.



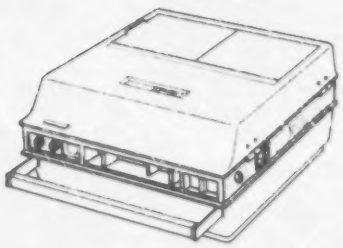
Sony AV-3400 Connections

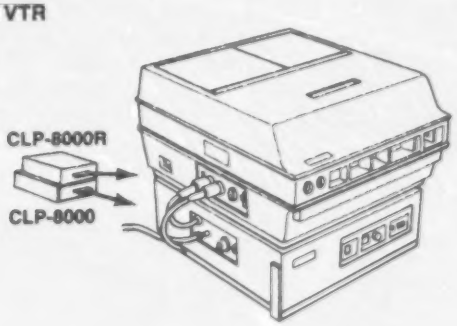
1. *EXT*ERNAL *POWER IN*—Plug in AC Power Adaptor or Long-Life battery.
2. *CAMERA* OR *TV* MONITOR—Use the 10-Pin plug for recording with the AVC-3400/AVC-3450 camera or use the VMC-1M (10-Pin to 8-Pin cable) for tape playback on a monitor.
3. INPUT SELECTOR—Select either CAMERA or TV MONITOR input.
4. *TRACKING* CONTROL—Adjust for correct playback of tapes made on other EIAJ VTRs.
5. *RF OUT*—Use the optional RF Adaptor (RFU-53W), a 2-piece unit. *See Chapter 7 and 8—Playback with RF Adaptor.*

The AV-8400S requires the AC-1000C Power Adaptor which includes 2 color plug in modules (color packs), the CLP-8000R for recording and the CLP-8000 for playback.

The AV-8400S is a good machine, a little more complex than it needs to be and not quite as dependable as the AV-3400 VTR. I find the AV-8400S' automatic threading mechanism of little real value, yet it adds weight.

AV-8400S VTR





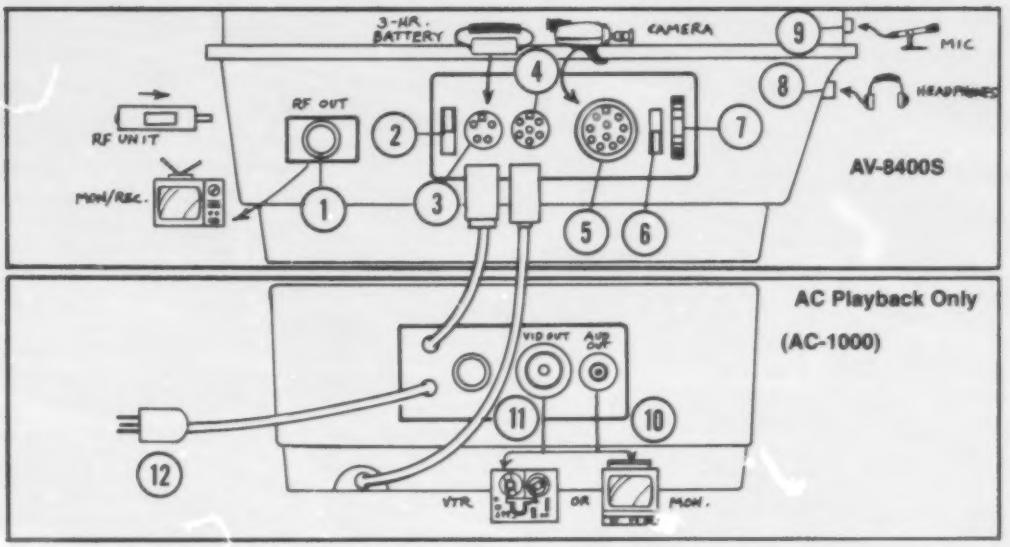
THE SONY AV-8400S COLOR PORTABLE VIDEO SYSTEM

The AV-8400S is a completely redesigned second generation ½-inch EIAJ portapak. It features automatic threading of special tape, improved sync, better picture quality, a built-in drop out compensator and color recording capability. Unfortunately the AV-8400S has become an extinct species due to "the lack of market demand" and Sony's preference for pushing the ¾-inch videocassette systems for color use.

Color Operation

To record and playback in color, the optional color pack CLP-8000 (larger module) must be inserted in the AC-1000C AC Power/Battery Charger and the CLP-8000R (smaller module must be inserted in the AV-8400S deck. Otherwise, the unit will record and playback in b&w only.

NOTE: For specific control functions see AV-3400.



AV-8400S Side View—Input Output Panels

1. *RF OUT*—Connect to any conventional TV set (VHF Terminals). You must plug the optional RF Adaptor in the rear of the AV-8400S VTR first. Optional RF Adaptors may be purchased for color (RFK-2[illegible]4 FW) or b&w (RFU-62-65 FW). The RF Adaptor package includes antenna plugs, matching transformer and cables.

NOTE: The color RF Adaptor is interchangeable with all the Sony Type II videocassette units except models VO-2800 and VO-2850.

2. *B/W COLOR* MODE Selector—Selects b&w or color mode.
3. *DC IN*—4-Pin DIN DC power plug—connect to AC-1000C Adaptor for AC operation and battery charging or to long-life 12 Volt external battery.
4. *VIDEO*—Connect to the AC-1000C for color playback.
   NOTE: You must have AC power for color playback.
5. *SOURCE*—10-Pin Plug—Connect to AV-3450 b&w camera or to DXC-1600 color Camera Control Unit (CCU). Do not try to plug DXC-1600 color camera in directly. It will not work. You may also use this plug for tape playback on a TV monitor.
6. INPUT *SOURCE* SELECTOR—Set for proper input source:

7. *TRACKING* CONTROL—Adjust during playback for best picture.
8. *MIC* INPUT—Plug in a good quality low impedance microphone here.
9. *EARPHONE* OUT—Use SENNHEISER HD-414 headset (optional purchase)

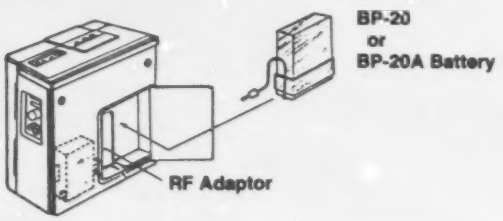
AC-1000C AC Power Adaptor/Battery Charger

10. *AUDIO OUT*—Auxiliary connection for use with VTR, monitor or sound amplifier system. Use for editing and dubbing.
11. *VIDEO OUT*—For external use with VTR, monitor, or video projector. Use for editing and dubbing.
12. *AC* PLUG—120 Volts AC, plug into a wall socket.

POWER AND THE PORTAPAK

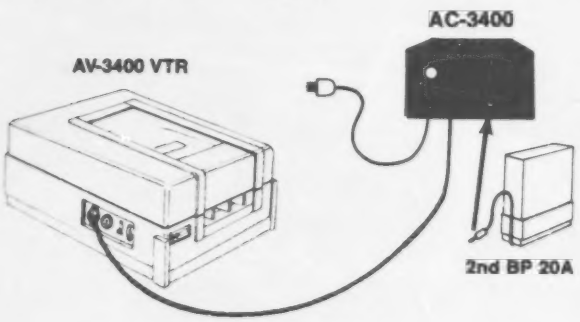
Battery Operation

Nearly all the internal circuits in video equipment operate on DC power—even AC only units. Of course, only portable VTRs and Cameras are actually able to plug directly into DC (battery) power. Since it doesn't matter to the portapak whether it receives battery or AC power, avoid the hassles of batteries and use the AC Power Adaptor if its convenient.



Battery Insertion

Battery pack BP-20 fits inside the VTR and can be charged while inside the VTR by plugging in the AC Adaptor/Battery Charger. The battery pack will then charge automatically when the AC-3400 charger is turned on or the RESET button is pushed on the AC-1000C.



Battery Charging Procedure—AV-3400

Step 1 Plug in the AC Adaptor/Charger to the VTR and a wall socket.

Step 2 Turn the power switch ON. The pilot lamp will light.

Step 3 Set the function lever on the VTR to STOP.

Step 4 Charge for at least 8 hours (overnight).

Dual Battery Charging

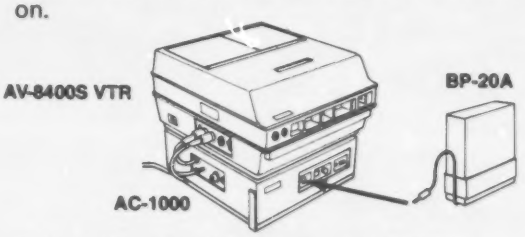
A second BP-20 battery may be charged simultaneously by using the plug marked BATT on the front panel of the charger.

Battery Charging

The battery *WILL NOT* charge while the VTR is recording or playing back off AC current. Under perfect conditions, a fully charged BP-20 battery pack will allow approximately 45 minutes of VTR and camera operation or 60 minutes of VTR playback only. The battery may be left inside the VTR while operating and charging.

Battery Check

The battery meter on the front panel of the VTR shows battery condition when the RECORD LEVER is moved to the left or the VTR is turned on.



Battery Charging Procedure—AV-8400S

Step 1 Plug in the AC-1000C AC Adaptor/Charger into the VTR and a wall socket.

Step 2 Turn the AC-1000C *ON*. The green light may light.

Step 3 Set the function lever on the VTR to STOP mode.

Step 4 Push the RESET button on the charger.

Step 5 Charge for at least 8 hours. The charger will turn off the charging cycle automatically when it is complete.

CAUTION:

The battery meter will not register in STOP, FF or REWIND modes.
DO NOT operate the VTR or camera when the BP-20 battery is very low as this will cause permanent damage to the battery.
VTR must be in STOP mode while recharging.

Low Battery Symptoms:

AVC-3400 camera and AVC-3450 camera

- Picture out of focus or cannot be focused
- Diagonal lines in camera viewfinder
- Discharge reading on meter (red zone)

AVC-3450 camera only:

- The red light on the left side of the viewfinder will go out.

Portapak Power Sources

Gel-Cell Batteries—BP-20

The battery that originally came with the ½-inch portapaks was made of lead gelled acid and will power a portapak for 30 to 45 minutes on a full charge. The GEL-CELL, designated the BP-20 by Sony, does not have the power density of the longer life batteries such as the Nickel Cadmium type, but unlike the temperamental NI-CADS, the Gel-Cells cannot explode and can take considerable charging abuse. However, the Gel-Cell will crack if dropped and corrode the VTR. Also, the plugs and wires on the battery are very weak and can break easily and will burn up the battery instantly if the wires are shorted out.

The BP-20 must be charged with the AC-3400 or the AC-1000C AC Adaptor/Battery Chargers which are preset to a specific charging cycle. Any other charging method will ruin the batteries.

The BP-20A Battery

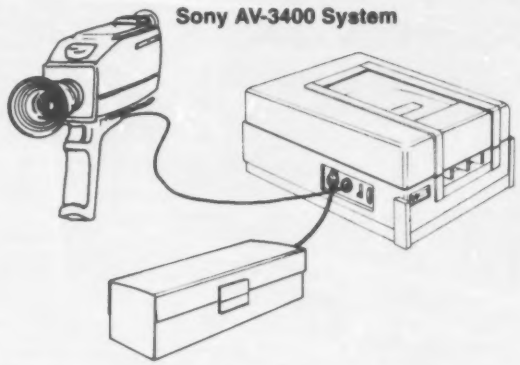
The BP-20A is a small size Ni-Cad type battery, identical in size to the BP-20. The BP-20A, is supplied with the AV-3400 and the Sony color camera DXC-1600 and the VO-3800 ¾-inch portable videocassette unit. The BP-20A will provide 1 to 1½ hours of recording time, and it can be used very effectively with both the AV-3400 and AV-8400S VTRs.

CAUTION: Do not charge a BP-20 and a BP-20A simultaneously with the same charger.

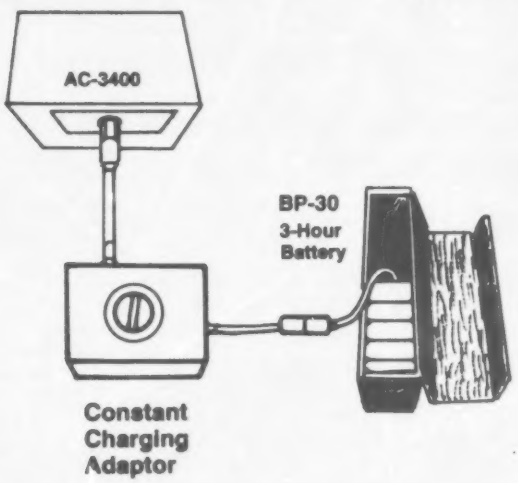
The BP-30 Sony "Long Life" Battery:

The BP-30 is a sealed series of 10 (nickel cadmium) cells tied together. Ni-Cad batteries are lightweight, and they have excellent power capabilities. The BP-30 is reliable, compact, and well worth the $130 for a good remote power source. However, they're temperamental batteries, and they need to be charged carefully or they will explode, destroy the charger, or suffer a major core meltdown. Unfortunately, the cheap "black box" charger that comes with the BP-30 is not a good charger, and if left on much beyond the 14-hour recommended charging cycle, it will severely damage the batteries by overcharging.

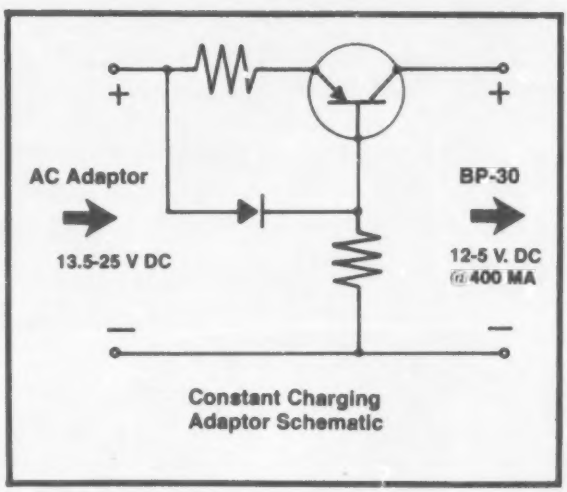
Sony AV-3400 System



What the BP-30 really needs is a constant charging adaptor which will only supply 400 MA (milliamps) during the charging cycle. Then it cannot overcharge. The *ALTERNATE MEDIA CENTER* workbook suggests this charging method and circuit design for a constant charging adaptor.



Constant Charging Adaptor



Constant Charging Adaptor Schematic

The Memory of a BP-30

Ni-Cad batteries have the peculiar characteristic of remembering only the least amount of work that they did last as opposed to the amount of work they really can do. (They must have learned this from being around people.) Thus the BP-30 will become accustomed to being drained down to 11 volts (vs. 14 volts at full charge) and not go any further. To restore the full power cycle, place the VTR in RECORD mode by placing a piece of cardboard against the automatic shut-off mechanism and let the VTR run until the battery meter is in the red. Now, recharge the battery for 14 hours but be careful not to overcharge it.

NOTE: The constant charging adaptor eliminates these problems.

The Power Draw of the VTR

The Sony portapaks will run on 11 to 14 volts of DC power. Operation in the RECORD mode requires the most amount of power because of the need to run the VTR motors and the camera at the same time. PLAYBACK mode and STANDBY mode draws only 1 amp, only ½ as much power. Overall the portapak draws 3 amps of current, and household circuits will supply 15 amps, so there's lots of power left over to run lights and monitors.

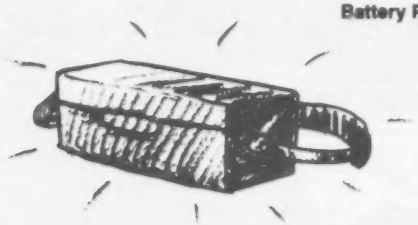
Life Expectancy of Batteries

Obviously, the rated life of a battery will vary depending on its use—recording or playback. The BP-30, so called 3 hour battery, cannot really record for more than 2¼ hours under ideal conditions. It's considered good if you can get 1½ hours out of it. It should last for at least 500 charge and re-charge cycles or 4 or 5 years with love and care.

Battery Repair

Often only 1 cell will go bad, but this affects the whole battery. Individual cells can be replaced for about $10 per cell plus labor. You should take the battery to a good technician, because if you short out the leads, the whole battery may burn up.

Battery Pack



The Elpower Battery

Another battery option for the portapaks is the ELPOWER long life battery. It's guaranteed to give *at least* 3 hours, and it should give 4 hours of power. For the price of 1 BP-30 ($130) you can purchase 2 Elpower long life batteries, the carrying case, charger, and have 6-8 hours of power. The Elpower is specifically designed for the Sony and Panasonic portapaks. However, it is not distributed through Sony or Panasonic. You need to order from the company, see a big video dealer, or order from the Comprehensive Video Supply Corp.

The disadvantages of the Elpower 4 hr. battery include a greater weight—about 2½ times as heavy as the BP-30 and about 3 times as large. This is because the Elpower is a Gel-Cell type and not a Ni-Cad type battery. That's why it's so much cheaper. If you don't mind the extra weight and size, it's a good battery system, especially for the price.

Other Batteries

Used and Army surplus batteries can be used, but find out how much power they put out, what kind they are, and how to properly charge them. Otherwise you risk damage to the VTR and/or your body. Write to GOULD NATIONAL BATTERIES in Minnesota for their "Battery Handbook."

Other Power Sources

The portapaks will operate on just about any 12-volt DC power source. Motor vehicle options include the car battery adaptors (Sony DCC-2400), and power generators—such as the TRIPLITE generator (available from LAFAYETTE ELECTRONICS), and 12 volt motorcycle batteries. Motorcycle batteries are not recommended as they can leak acid and catch fire.

Battery Care

- When storing batteries, put a charge on them and recharge every 6 months.
- *DO NOT* subject batteries to extremes of cold or heat—32°F to 110°F.
- Batteries will lose effectiveness in cold weather and self destruct if overheated.
- Connecting plugs and wires are weak, be careful.
- *DO NOT* pull the plug out by its wires.
- *DO NOT* overcharge. This is not a problem with the BP-20 and the AC-3400 and AC-1000C Chargers.
- *DO NOT* keep shooting with the BP-20 battery when the battery meter is in the red zone area.

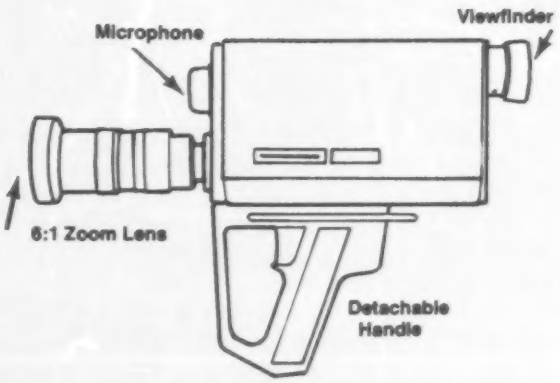
Interchangeability

It seems that most Sony and Panasonic batteries are interchangeable with each other and the 4-Pin battery/power plugs are also identical.

SONY PORTAPAK CAMERAS

There are 3 portable cameras that can be used with the AV-3400 and AV-8400S VTRs.

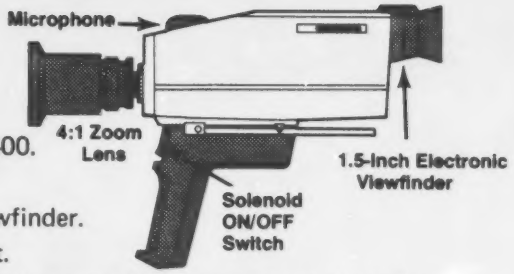
AVC-3400



1) The AVC-3400 Black-and-White Only Camera

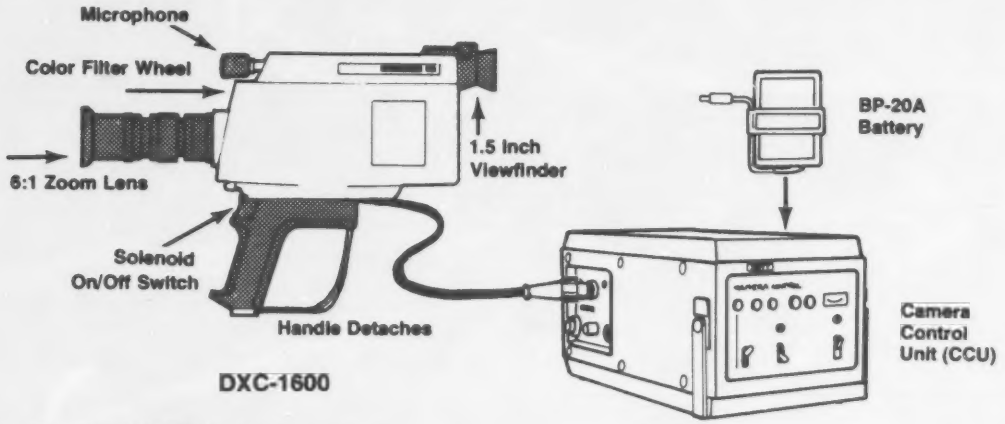
The AV-3400 is an older model, a heavier camera (about 8 pounds), and it needs a fair amount of light—about 50 footcandles. The hand grip detaches for a more secure fit on the tripod.

2) The AVC-3450 Black-and-White Only Camera



Features:

- Contains larger viewfinder—1½ inch
- Better microphone and more stable sync.
- Pictures are cleaner and sharper than the AVC-3400.
- Hand grip does not detach.
- Has battery charge level indicator light in the viewfinder.
- ON/OFF switch solenoid operated and very quiet.
- Comes only with a 4:1 lens—f. 1.8 (if you can, pay the extra $75 or so and get the 6:1 lens with the camera).
- Can be used with both the AV-3400 and the AV-8400S.
- Will not work with studio cameras or non-portable VTRs without the CMA-4 adaptor. *See CMA Adaptors, this chapter.*
- Newer model, very lightweight—only 4 lbs. Electrostatic Vidicon assembly.
- Good low light sensitivity, will work in 10 to 20 footcandles.



DXC-1600

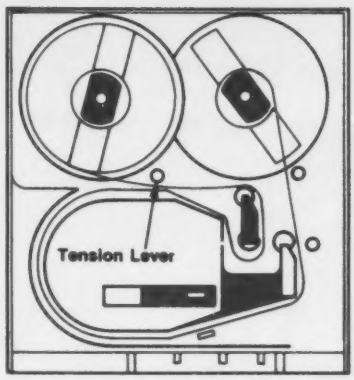
3) The DXC-1600 Color Camera

Features:

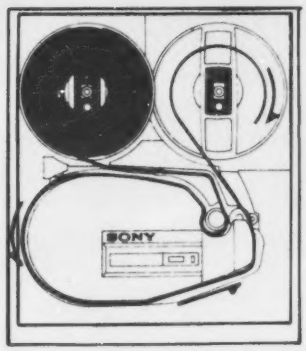
The DXC-1600 is a high quality, single-tube portable color camera.

- Comes with a 6:1 F 2.5 Zoom lens
- Has a built-in behind-the-lens filter wheel
- Needs 100-200 footcandles of light to produce good color
- Relatively heavy—9 lbs. for the camera body and lens and 6 lbs. for the Camera Control Unit. (The camera cannot be operated without the CCU.)
- CCU requires its own battery to power camera—the BP-20A
- Camera hand grip is detachable
- ON/OFF switch is very quiet-solenoid operated
- Large 1½ inch viewfinder
- Battery level indicator light in viewfinder
- Works with both portable VTRs and studio VTRs without adaptors
- Supplies its own sync or can take external sync from SEG system

VTR OPERATIONS



AV-3400



AV-8400S

VTR Tape Threading Procedure

Step 1 The VTR must be in the STOP mode, and no whirring sounds should be present.

Step 2 Open the VTR lid and place an empty reel on the right side of the VTR as it faces you. Turn the reel slightly while exerting gently downward pressure.

Step 3 Place a full reel of tape on the left side of the VTR. Make sure the reel is properly seated.

Step 4 Unwind 2 or 3 feet of tape, and thread the tape through the VTR, following the arrows. Be sure to thread the tape *BELOW* the tension lever. Check the threading diagram inside the VTR lid if in doubt.

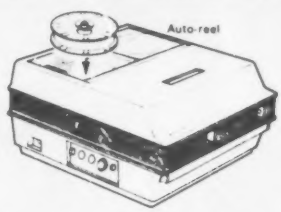
NOTE: Make sure the tape is threaded *between* the capstan and the pinch roller or the recording may be useless.

Step 5 Wrap the tape around the hub of the empty take-up reel. Rotate the reel with your finger against the hub to make one turn *counterclockwise* for the AV-3400 and one turn *clockwise* for the AV-8400S. They wind in the opposite direction. As soon as the tape slack is taken up, remove your finger and visually recheck your threading.

Step 6 Place the VTR in the PLAY mode for 5 to 10 seconds and listen for any strange sounds or crunching tape. If all looks and sounds OK, you are now ready to record or play back.

AV-8400S Automatic Threading System

The AV-8400S *only* can be threaded automatically when using the special take-up reel and special 20-minute Sony V-35 self-threading tape.



Loading Procedure

Step 1 Open the VTR lid and place the special auto-threading take-up reel on the right side of the VTR. Close the lid.

Step 2 Slide the supply-reel access door open (left panel of VTR lid) and carefully place the full auto-threading tape (Sony V-35) onto the supply-reel spindle. Make sure the tape reel keys onto the flanges and wire guide post on the spindle.

Step 3 Seat the tape by pressing it downward and turning the reel slightly.

Step 4 Place the VTR in FWD mode, and the tape will automatically thread.

Step 5 When the tape is threaded, push the function lever to the STOP position, otherwise the VTR will just keep on going. If the tape doesn't attach to the take-up reel, the VTR should stop automatically after 15 seconds.

NOTE: At the end of the tape, the VTR will stop and automatically rewind. However, it usually produces a frightening racket when the front leader is finally rewound onto the supply reel. Don't let it scare you, just turn the VTR to the STOP mode.

More Notes on the Auto-Threading Tape

Only special self-threading reels of videotape can be used on the machine when using the auto-threading mode. The self-threading supply reel is identical to the self-threading supply reel inside the Panasonic and Shibaden ½-inch EIAJ cartridges. So, you could interchange the reels once you removed them from the plastic cases.

Although the tape format itself is standard ½-inch EIAJ, the tape has a front and back plastic leader attached to it in order to facilitate the auto threading. This plastic leader is wider than the ½-inch tape and thus needs a special take-up reel and cannot be played on any standard reel-to-reel ½-inch VTR like the AV-8650, AV-3600, or other standard VTRs without risking severe damage to the video heads and head drum mechanism when the plastic leader passes the video head. If you remove the plastic leader, the tape can be used on any other ½-inch EIAJ VTR. *See Splicing Plastic Leaders, Chapter 14—Maintenance.*

The self-threading idea is fine for those few folks who don't intend to edit their tapes or play them back on non-AV-8400S VTRs. The self-threader works quite well and sure saves time and energy. For uses such as sports or video workshops, the self-threader is dynamite. But for serious production purposes, it just adds a lot of extra weight and makes it more difficult to manually thread.

RECORDING WITH CAMERA AND VTR

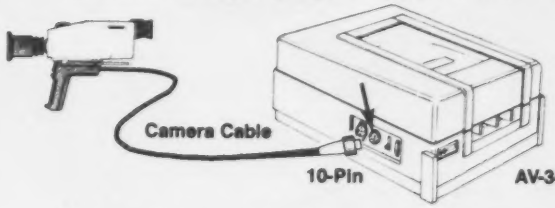
Procedure for all black-and-white camera models

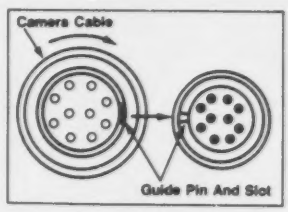
Read the instruction manual thoroughly!

Step 1 Make sure the tape is properly threaded.

Step 2 Connect the 10-Pin cable from the camera to the 10-Pin plug on the side panel of the VTR, being careful *NOT TO FORCE* the 10-Pin plug into the socket.

NOTE: The keyed plug will only fit in one way.

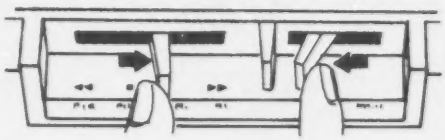




Step 3 Make sure the INPUT SELECTOR SWITCH or SOURCE SELECTOR SWITCH is set to the CAMERA position, otherwise no picture can be seen in the camera. Set the MODE selector on the AV-8400S to B&W.

To Start Recording with All Models—B&W and Color:

Step 1 To monitor the scene, move the RECORD LEVER to the left with your index finger—a whirring sound will be heard with the AV-3400.



Step 2 Hold the RECORD LEVER in the full left position with your index finger and then move the FUNCTION LEVER to the FWD position with your thumb. The VTR is now ready to record and is in the STAND BY position.

NOTE: If the VTR is moving tape through the machine, squeeze the camera trigger switch to the *OFF* position.

Step 3 Wait for the camera to warm up and adjust the lens and/or the light for a good sharp picture with a full range of good blacks and whites (contrast).

Step 4 Plug in the earphone or the headset to monitor the sound as it is being recorded.

Step 5 Squeeze the camera trigger switch, and the VTR will start recording. The sound and video levels are adjusted automatically.

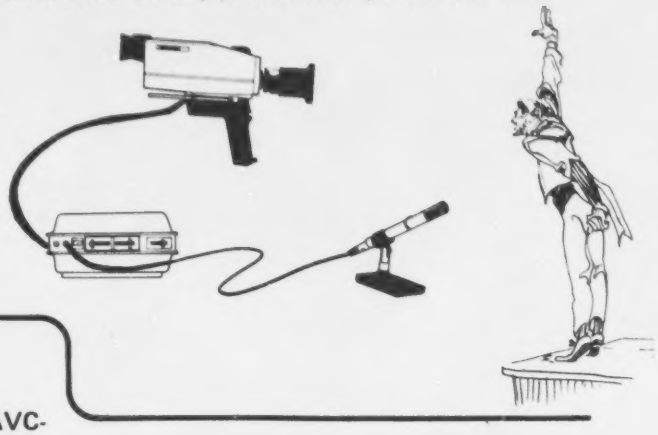
Step 6 Press the trigger switch again when you are finished recording the scene, and the VTR will stop.

Step 7 When all recording is finished, move the FUNCTION LEVER SWITCH *immediately* to the STOP position, otherwise the battery will run down.

CAUTION: Turn OFF the VTR to conserve battery power when you are not monitoring or recording.

Recording with the External Microphone

A good low-impedance, unidirectional external microphone should always be used instead of the built-in microphone if good quality dialog or sound is required. When plugged into the VTR, the external microphone will *cancel out* the built-in microphone in the camera.

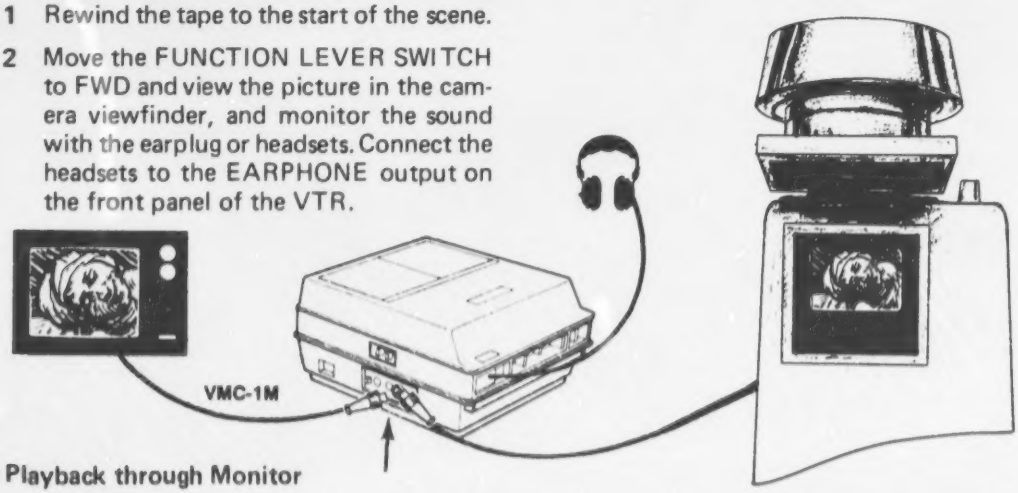


VTR PLAYBACK PROCEDURE

Playback through the Camera Viewfinder—AVC-3400 and AVC-3450 Cameras

Step 1 Rewind the tape to the start of the scene.

Step 2 Move the FUNCTION LEVER SWITCH to FWD and view the picture in the camera viewfinder, and monitor the sound with the earplug or headsets. Connect the headsets to the EARPHONE output on the front panel of the VTR.



Tape Playback through Monitor

Step 1 Plug the VMC-1M (10-Pin to 8-Pin) connector cable into the 10-Pin receptacle on the VTR. Be sure to remove the camera cable first. Plug the other end of the 10-Pin to 8-Pin cable into the monitor.

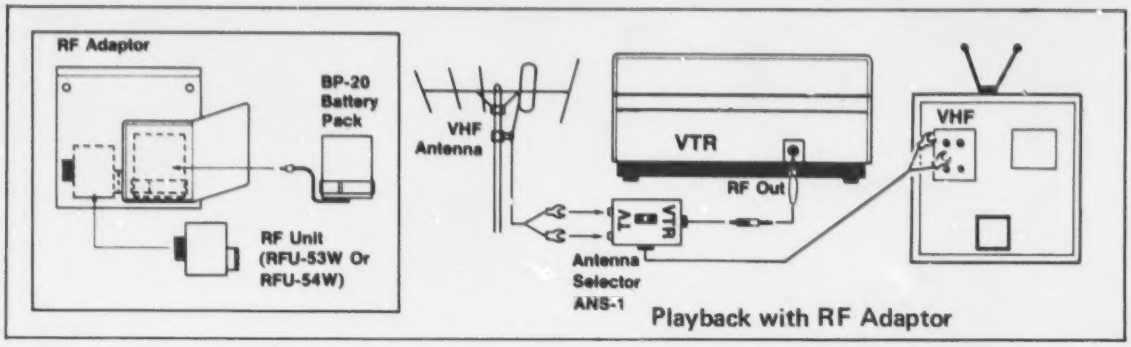
Step 2 Switch the INPUT SELECTOR or SOURCE SELECTOR to TV or TV/LINE.

Step 3 Rewind the tape and place the VTR in FWD mode. Adjust the monitor for the best picture and sound.

Playback with an RF Adaptor—All B&W Model Portapaks

Step 1 Insert the RF Adaptor module into the bottom of the AV-3400 or the rear of the AV-8400S.

Step 2 Connect the mini-plug end of the TV connector box into the RF OUT receptacle in the back of the AV-3400 or on the left side of the AV-8400S.



Playback with RF Adaptor

Step 3 Connect the terminal end of the TV connector box to the VHF terminals of the TV set.

Step 4 Be sure to tune the TV set to whatever channel the RF unit is set—usually channel 3 or 4. Check the RF unit for the designated channel.

NOTE: There will always be some distortion or GLITCHES in the picture during transitions between scenes. This happens because the tape must achieve its required speed before a clean picture can be recorded. This may also be due to excess slack in the tape when the VTR starts.

Picture Adjustments

Adjust the TRACKING control on the side of the VTR for cleanest picture. Normally it should be left in the *center* position for playback.

Sound Dubbing Procedure

New sound can be added without erasing the picture by using the external mic.

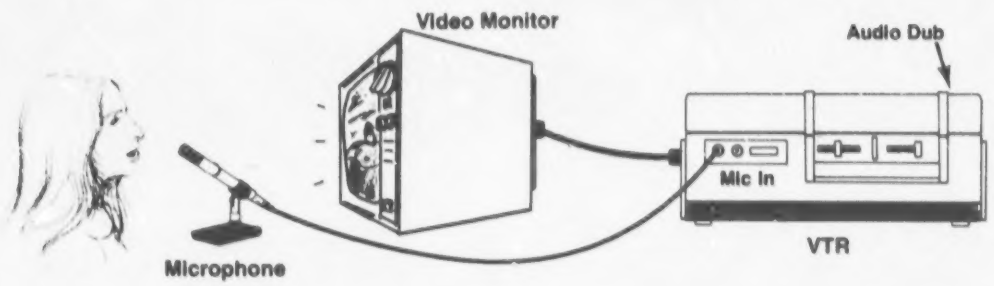
Step 1 Connect the sound source (mic) to the VTR EXTERNAL MIC input.

Step 2 Play back the pre-recorded tape on the monitor.

Step 3 When the sound dub point is reached, STOP the tape.

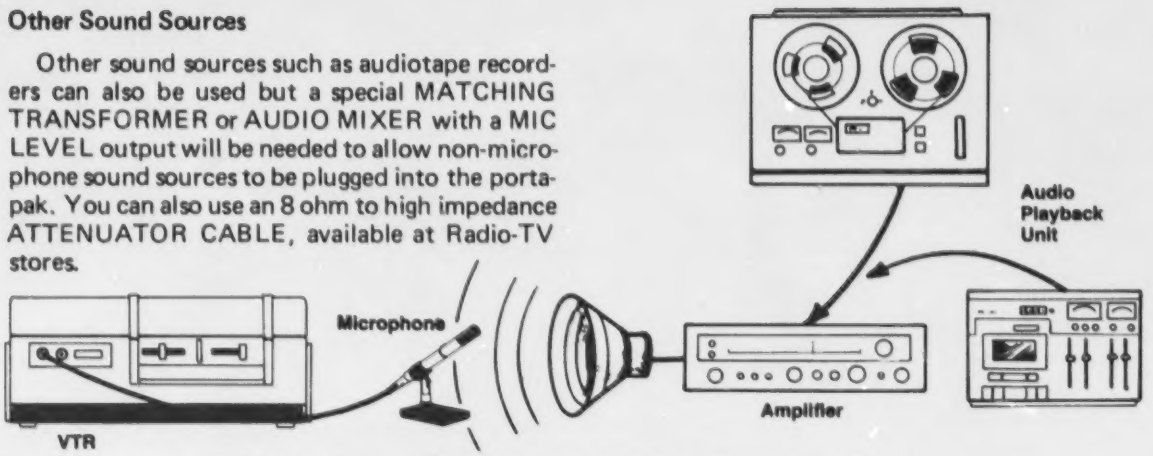
Step 4 Pull the SOUND DUB knob to the left and move the FUNCTION LEVER to the FWD position. The new sound is now being recorded.

Step 5 At the end of the sound dub, STOP the VTR.

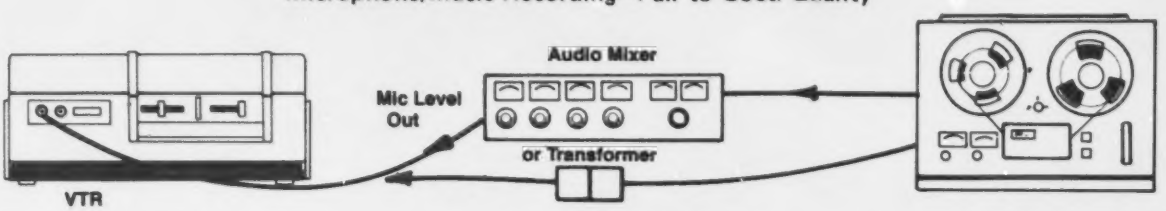


Other Sound Sources

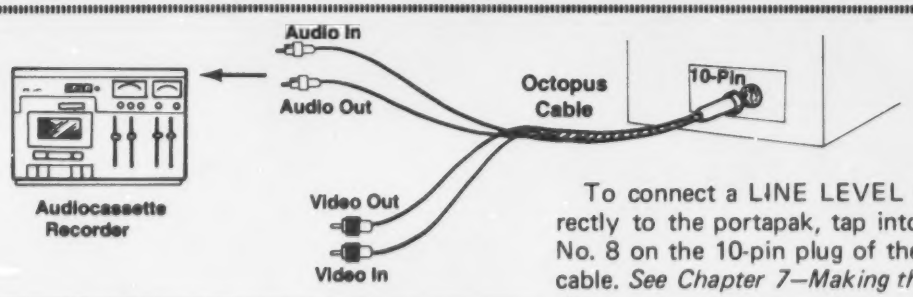
Other sound sources such as audiotape recorders can also be used but a special MATCHING TRANSFORMER or AUDIO MIXER with a MIC LEVEL output will be needed to allow non-microphone sound sources to be plugged into the portapak. You can also use an 8 ohm to high impedance ATTENUATOR CABLE, available at Radio-TV stores.



Microphone/Music Recording—Fair to Good Quality



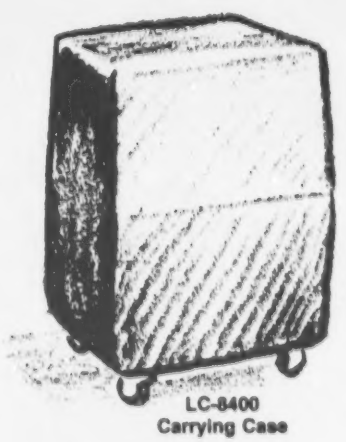
Mixer/Transformer Direct Recording—Good to Excellent Quality



To connect a LINE LEVEL sound source directly to the portapak, tap into pins No. 7 and No. 8 on the 10-pin plug of the 10-Pin to 8-Pin cable. *See Chapter 7—Making the Right Connections.*

Vital Accessories for All Portapaks

- EXTERNAL MICROPHONE and 50 feet of mic cable. Use Sony ECM SERIES condenser mics, the Electro-voice 635 or any good condenser mic.
- CAMERA EXTENSION CABLE—Allows great freedom of camera movement and the VTR does not have to be carried around as much—Use the 32 foot CCJ-10. *REQUIRED!* ($90)
- VIDEOROVER CARRYING CASE—Use the LC-3400 for the AV-3400 and the LC-8400 for the AV-8400S ($120 - $165)
- TRIPOD—Any good movie type tripod will do. The fluid head MILLER TRIPOD is the best and really makes your camera work look professional ($250 - $400).
- SHOULDER MOUNT for the camera ($80 - $150).



LC-8400
Carrying Case

Sony LC-8400
Carrying Case

·LONG LIFE BATTERY—Use the Sony BP-30 or the Elpower.

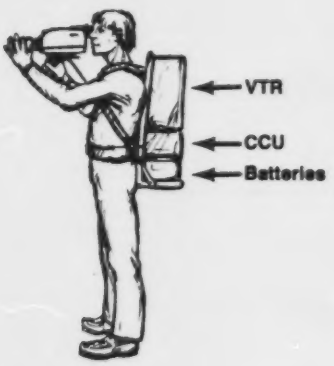
·WIDE ANGLE LENS—8.5 m/m for the b&w cameras only ($80 - $180).

·PORTA BRACE™—A nifty backpack system that allows the VTR and the CCU for the color camera to be placed on the back. A variety of models are available from: K and H Products Ltd.
Main Street
North Bennington, VT 05257

·RF ADAPTOR—For viewing VTR playback on a TV set ($90 - $120).

·QUALITY HEADSET—For monitoring sound—SENNHEISER No. HD-414 or an equivalent headset ($45).

Portabrace



PORTAPAK PRECAUTIONS

·*DO NOT* point the camera at the sun—*EVER, EVEN WHEN OFF.* The camera tube will burn immediately. Keep the lens cap on when the camera is not in use, and keep the lens aperture ring in the *"C"* or closed position.

·*DO NOT* store or carry the camera in a lens down position. Flakes and deposits created in the vidicon tube will fall and adhere to the face of the camera tube causing permanent black spots in the picture.

·*STRAPS SLIP OFF* the shoulder bag on the AV-3400—*be careful.*

·Make sure the AV-3400 VTR is fully zipped up in the shoulder bag before moving, otherwise the VTR will fall out of the bag when lifted.

·RECORD and PLAY knobs break off if forced. *NEVER FORCE ANYTHING!*

·Always move the RECORD knob over first when you are recording.

·*Do not* drop the batteries—*INSTANT DEATH!*

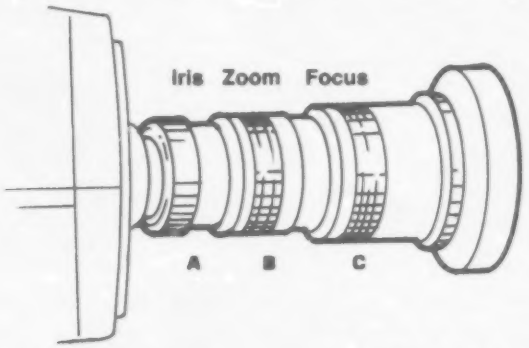
·Keep the VTR in a horizontal position if possible for the best sync and tracking results.

CAMERA OPERATION—All models *(See Camera Set-Up and Care of Vidicon Tube and Lenses, Chapter 4—The Video Camera)*

Step 1 Hand hold camera or place camera on tripod or shoulder. (The hand grip on the AVC-3450 does not detach.)

Step 2 Place the VTR in the RECORD/STAND BY MODE.

Step 3 Adjust the lens for the best light—open lens aperture.



General Lens Openings:	
sunny day—	f 8 or f 11
cloudy bright—	f 5.6 or f 4
inside—	f 4, 2.8 or 1.8

Step 4 Turn the ZOOM control and *"ZOOM ALL THE WAY IN"* so the image is close up and very large.

Step 5 Turn the FOCUS ring until the image is sharp. Now ZOOM back out, and the image should stay in focus as long as the subject-to-camera distance does not change. If it does, refocusing will be necessary.

Step 6 Pull the trigger on the camera to start recording. Pull the trigger a second time to stop recording.

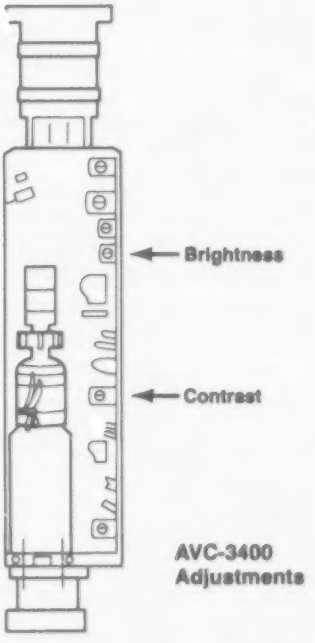
Viewfinder Controls—AVC-3400 Camera

The viewfinder picture occasionally differs from the image the camera really sees. The camera sees about 10% more picture area and produces better contrast and sharpness than what the viewfinder shows. You should test each camera, and be aware of the inconsistencies between the viewfinder and the actual recorded picture and compensate when shooting. Always make sure the camera is properly adjusted first.

Beware of Backlighting!

The picture will darken and lose detail when shooting a scene with lights or bright sky in the background. Because the video AGC circuit and target control circuit adjust automatically for the overall or average lighting in the scene, the bright backlighting will cause the AGC circuit to reduce the video level and therefore cause the subject to appear much too dark.

REMEDY—Avoid backlighted scenes or add light to the subject. Use artificial lights or reflectors to reflect the availabie light.



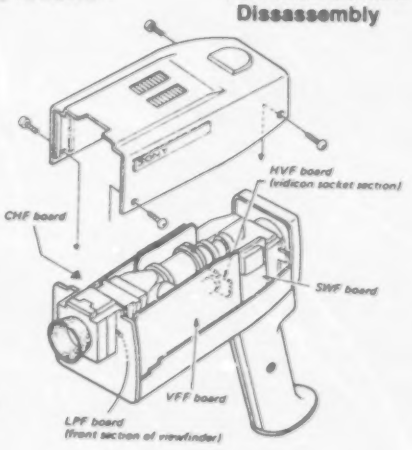
AVC-3400 Adjustments

Viewfinder Controls—AV-3450 Camera

The larger viewfinder (1½-inch), superior sensitivity and high resolution of the AVC-3450 camera make it easier to view the picture being photographed, and these features reduce the need to adjust the camera. Also, the AVC-3450 camera incorporates a battery level lamp indicator inside the viewfinder on the left side opposite the ON/OFF lamp. For some strange reason, the light goes *OFF* when the battery is low and drops below 11 volts. It seems it should be the other way around? "Do not operate the system when the battery lamp turns off as the ability of the batteries to be recharged will be impaired," so says Sony.

If the camera viewfinder needs adjustment, proceed as follows:

AVC-3450 Camera Disassembly



Step 1 Turn *OFF* all power, remove the screws from the top cover and remove the top cover.

CAUTION: Be careful not to break the internal microphone cable.

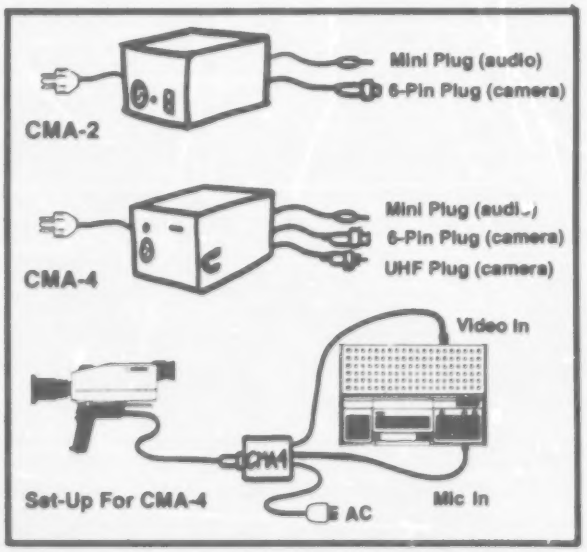
Step 2 Adjust VR-102 BRIGHTNESS CONTROL on the top front of the VFF circuit board.

Step 3 Adjust VR-205 CONTRAST control on the bottom center of CHF circuit board.

Step 4 Replace the cover and its screws.

Portapak Camera Adaptors

Since the portapak b&w cameras have no sync generator of their own, they must be "driven" by the internal sync generator in the portable VTR. But most nonportable studio VTRs do not have internal sync generators in the . Therefore, if you want to use an AVC-3400 or AVC-3450 camera with a videocassette recorder to a regular VTR deck like an AV-8650, you must purchase the CMA-2 or CMA-4 portapak camera adaptor (about $140).



These adaptors supply sync to the camera, and they also change AC to DC current for the camera. The adaptor converts the 10-Pin plug from the camera to a 6-Pin (CMA-2) or a 6-Pin and UHF (CMA-4) for direct connection into any studio VTR. Sound connections are also provided. Unfortunately and contrary to popular belief, both CMA adaptors supply only RANDOM SYNC or worse. Random sync is inadequate for quality programs that will require editing and dubbing. The cameras do receive 2:1 sync when they are plugged into the AV-3400 or AV-8400S VTRs because these decks contain internal 2:1 sync generators.

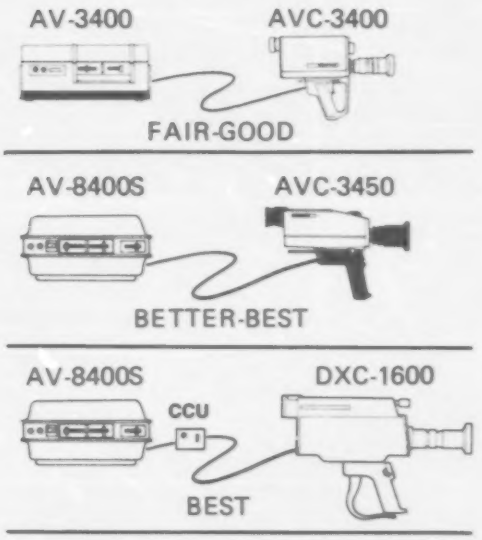
Luckily, Comprehensive Video Supply Corporation has again come to the rescue with a 2:1 sync portable camera adaptor. It's called the PORTA-DAPTER model 100, and it costs $199.95. It will work with ANY portable camera and also has external H SYNC and V SYNC outputs for multiple camera system use.

NOTE: Because of a difference in internal electronics, the AVC-3450 camera *will not* mix with an AVC-3400 or AVC-3200 series cameras in a multiple camera application even if using the CMA-4 adaptor.

A Word About Portapak Sync

Because of compromises inherent in portable VTRs, lack of sync stability is always a problem. Even though a VTR produces 2:1 sync, the sync pulse configuration is less than adequate for purposes like cable TV cablecasting and sophisticated editing and dubbing. The sync signal of the AV-3400 and AVC-3400 system is not great, so flagging (bending at the top of the picture on playback) occasionally happens. The AV-8400S system features a more accurate CRYSTAL SYNC GENERATOR, and the AVC-3450 camera is designed with a greatly improved sync circuitry. When it is used with the AV-8400S VTR, it produces a very stable picture easily suitable for cablecasting and time base correction. The DXC-1600 color camera features its own semi-broadcast color sync and is very stable.

Picture Stability Comparison:



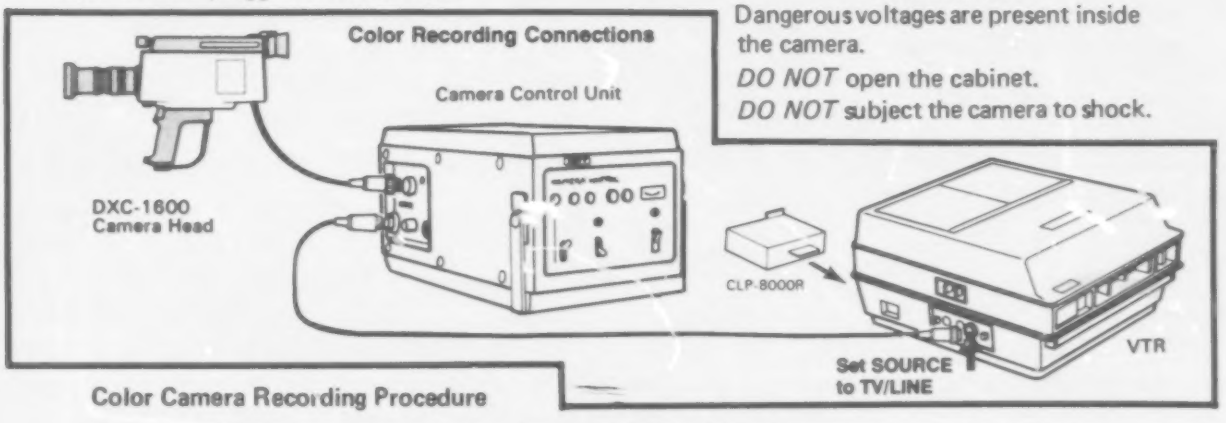
PROCEDURES FOR RECORDING COLOR

For color recording with the DXC-1600 camera, you need the AV-8400S VTR with the CLP-8000R color pack module installed inside the VTR. However, you can only RECORD color on the AV-8400S VTR. Color PLAYBACK requires the AC-1000C and the color pack CLP-8000 which fits inside it. The camera also requires its box, the CCU, which must be plugged into the VTR.

Color Camera Operation with the DXC-1600 Trinicon Color Camera

Though primarily designed for the VO-3800 portable videocassette recorder, the DXC-1600 will work with nearly any portable or studio VTR. A single pickup tube is used to sense all the chrominance and luminance information.

WARNING:
Dangerous voltages are present inside the camera.
DO NOT open the cabinet.
DO NOT subject the camera to shock.



Color Camera Recording Procedure

Step 1 Connect the camera cable from the DXC-1600 camera to the camera CCU. Connect the camera cable to the CAMERA HEAD PLUG.

Step 2 Connect the short 6 foot 10-Pin cable from the VTR plug on the CCU to the camera SOURCE plug on AV-8400S VTR.

Step 3 Confirm that the CLP-8000R color pack is in the compartment inside the AV-8400S VTR.

Step 4 Set the SOURCE selector switch to the TV/LINE input position.

CAUTION: It's certainly confusing to use the TV/LINE position as opposed to the camera position. Apparently no one considered this situation at the time of manufacture as the AV-8400S was designed prior to the DXC-1600.

The danger here is if you set the SOURCE selector to B/W CAMERA with the DXC-1600, the VTR will try to send sync pulses to the camera while the camera is forcing its own sync pulses back into the VTR. As a result, your playback will have a loss of sync line running throughout it constantly—thereby rendering your material useless. Unfortunately, this situation does not show up on the viewfinder while shooting so you aren't aware of the problem until it is too late—on playback.

So, the VTR must be told not to send sync pulses to the camera. This is what happens in the TV/LINE mode. You fool the AV-8400S into thinking it's recording from a monitor or another VTR.

Another problem in color recording is the positioning of the SOURCE selector switch. When connecting the 10-Pin cable to the AV-8400S, it's very easy inadvertently to bump the SOURCE selector switch with your fingers, moving it into the B/W CAMERA position. You should tape the switch in the proper position so it won't get changed accidently.

Step 5 Set the MODE selector to COLOR and reset the tape counter to 000.

Step 6 Install fully charged batteries in the CCU and VTR.

Step 7 Turn on the CCU POWER switch. The pilot lamp will light confirming that the batteries in the CCU and in the AV-8400S VTR are charged. Check the level meter on the AV-8400S and look for the red light on the left side of the camera viewfinder. The red light should be *ON*.

Step 8 Set the camera WHITE BALANCE. *See DXC-1600 Set-Up Procedure, Chapter 13—The Videocassette Portapak.*

Step 9 Place the VTR in the RECord mode and begin recording.

Playback of the VTR Through the Camera Viewfinder

If operating from a 12-volt battery or a car adaptor:

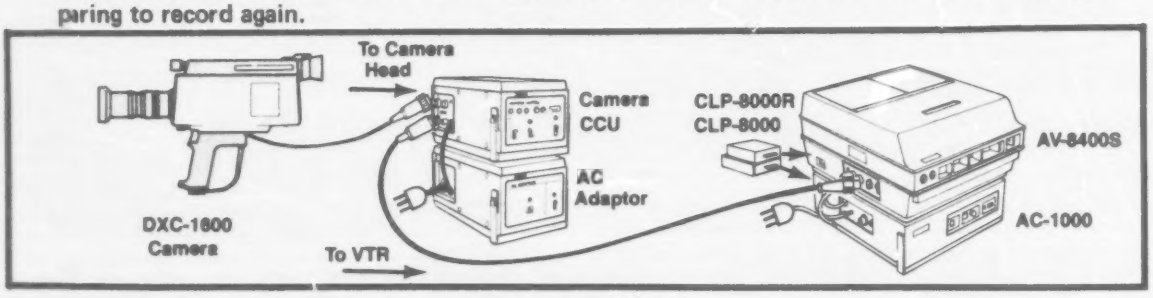
Step 1 Set the SOURCE selector on the AV-8400S to TV/LINE.

Step 2 Set the MODE selector to B/W.

Step 3 Set the CCU VF MONITOR switch to VTR. The indicator lamp will light.

Step 4 Raise the viewfinder screen to observe the playback in the camera.

CAUTION: Be sure to switch the MODE selector on the AV-8400S back to COLOR when preparing to record again.



Operation of the AV-8400S and the DXC-1600 on AC Power

Step 1 Plug the camera into the CCU, and plug the AC-1000C AC Adaptor/Battery Charger into the CCU.

Step 2 Plug the AV-8400S VTR and the AC-1000C AC Adaptor/Battery Charger together.

Step 3 Connect the camera CCU to the VTR. Use the 6 foot 10-Pin cable (CCJ-2). Make sure the SYNC SELECTOR switch on the camera CCU is in the INTernal sync mode.

Step 4 Thread the tape on the VTR. Turn everything *ON* and set the camera WHITE BALANCE.

Step 5 Begin recording.

Playback Through a TV Monitor in Color

Step 1 Connect *both* the 4-Pin power cable and the 6-Pin video cable from the AC-1000C AC Adaptor to the AV-8400S VTR.

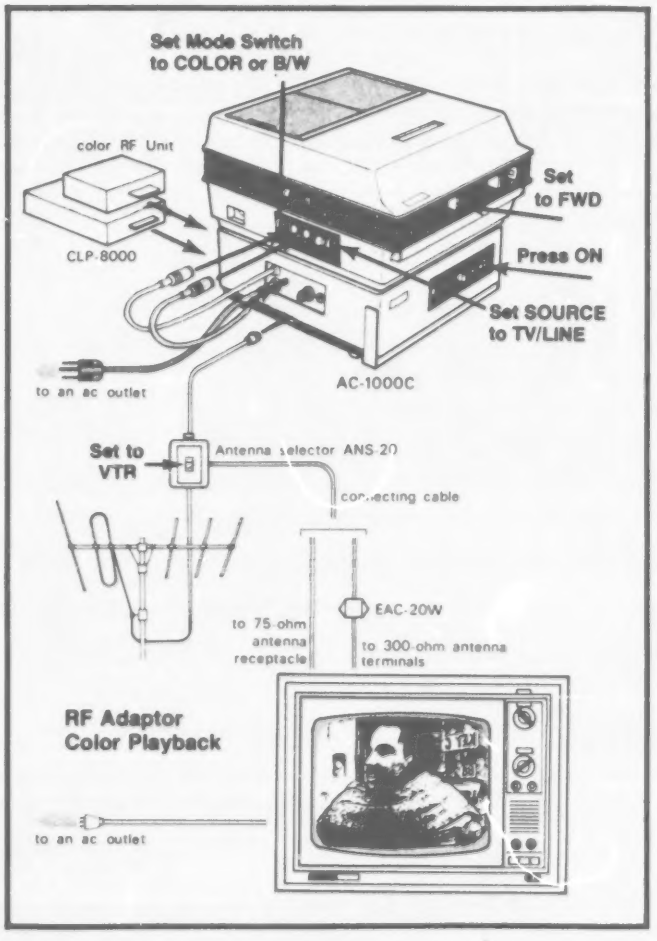
Step 2 Make sure the color packs are installed in both the VTR and in the AC adaptor.

Step 3 Connect the 10-Pin to 8-Pin (VMC-1M) cable from the VTR to the TV monitor. Turn everything *ON*. If the monitor does not have an 8-Pin plug, connect the coaxial cable (UHF) and mini plug audio cable from the VIDEO OUT and AUDIO OUT plugs on the side of the AC adaptor to the monitor connector plugs.

Step 4 Make sure the tape is rewound and set the VTR SOURCE selector to TV/LINE and the MODE selector to COLOR.

Step 5 Set the tape counter to 000 and start playback by moving the function lever to the FWD position.

Step 6 Sit back and enjoy the program.



Color Playback with the RF Adaptor

Use the RFK series color RF Adaptor for color playback and the RFU series RF Adaptor for b&w playback.

Step 1 Install the CLP-8000 color pack in the lower compartment and the color RF Unit in the upper compartment of the AC-1000C AC Power Adaptor.

Step 2 Connect the VTR and AC-1000C Adaptor together using both the 4-Pin and the 6-Pin plugs.

Step 3 Connect the TV receiver to the AC-1000C AC Adaptor using the RF cable and the antenna connector.

Step 4 Set the ANT/VTR switch on the antenna selector to VTR.

Step 5 Set the SOURCE selector on the VTR to TV/LINE and the MODE selector to COLOR.

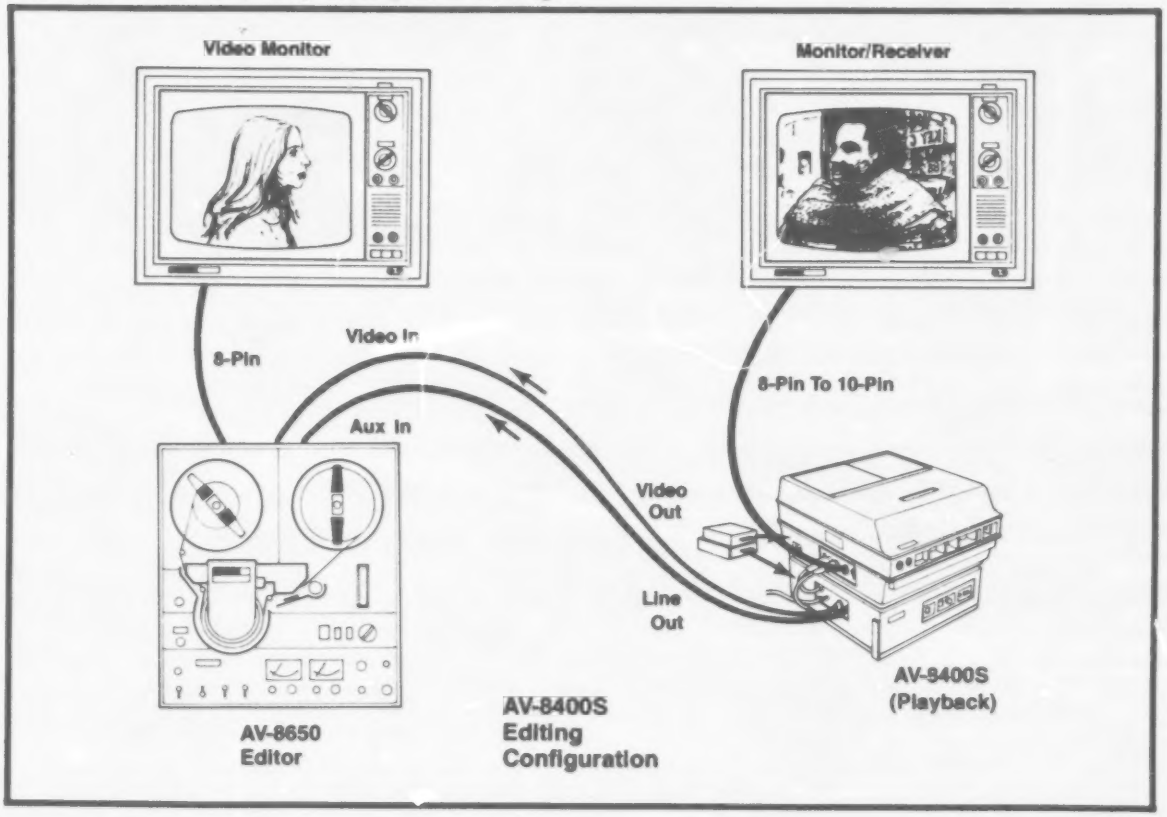
Step 6 Turn everything *ON*, and set the TV receiver to the designated RF channel (use Channel 3 if using RF Unit No. RFK-203 FW).

Step 7 To start the playback, set the FUNCTION LEVER SWITCH on the VTR to FWD.

Editing with the AV-8400S VTR

One of the best features of the AV-8400S system is video and audio output plugs on the AC-1000C AC Adaptor. These extra outputs permit direct editing and dubbing from the AV-8400S to any recording reel-to-reel or videocassette machine. Tapes recorded on the AV-8400S and played back from it will be quite stable electronically and well suited to quality editing and dubbing.

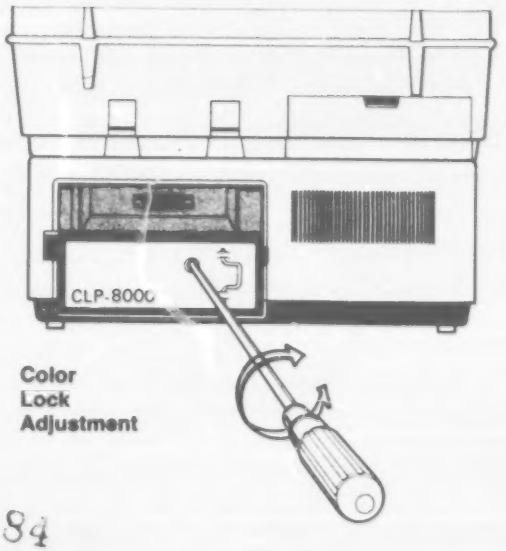
The AV-8400S also contains a built-in dropout compensator which greatly reduces noise and dropouts in the picture during playback. The color quality is excellent and the superior sharpness in b&w will also be apparent with the AV-8400S as opposed to any other ½-inch portable VTR. The AV-8400S is really a fine machine.



AV-8400S Editing Configuration

Picture Adjustments:

- Adjust the TRACKING control on the side of the AV-3400 or AV-8400S for the cleanest picture. For normal playback, leave the TRACKING control in the center position.
- COLOR LOCK ADJUSTMENT—AV-8400S only. This control is factory pre-set for the correct color, but if the VTR cannot maintain the correct hues, adjust the COLOR LOCK CONTROL. Insert a screwdriver in the color lock access hole of the CLP-8000 color pack in the back of the AC-1000C Power Adaptor. Turn the control until the color is corrected. Normally, the color lock control should remain in the DETENT (grooved) position.



Color Lock Adjustment

AV-8400S VTR Idiosyncracies

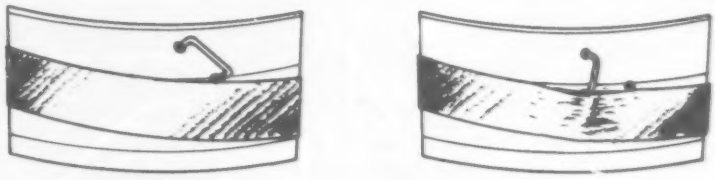
Freak Out No. 1

The switches get confusing! Because of the various COLOR/B&W, TV/LINE/CAMERA combinations, it's easy to have the switches in the wrong configuration. Generally, you won't get a picture in the camera if the switches are not set right. But with the DXC-1600 camera, you can make 2 serious mistakes without knowing it.

> **AV-8400 Catastrophic Errors**
>
> Leaving the MODE Selector in the B&W position when shooting color (you forgot to change the switch back to COLOR after playback in the camera viewfinder). Leaving the SOURCE Selector in the B/W CAMERA position when shooting with the DXC-1600 camera (no sync).

Freak Out No. 2

The playback of the tape shows constant distortion and loss of picture. The symptoms at first appear to be broken video heads, but they turn out to be a bent wire tape guide which presses against or gets underneath the tape and prevents it from contacting the rotating video heads.



Normal Bent

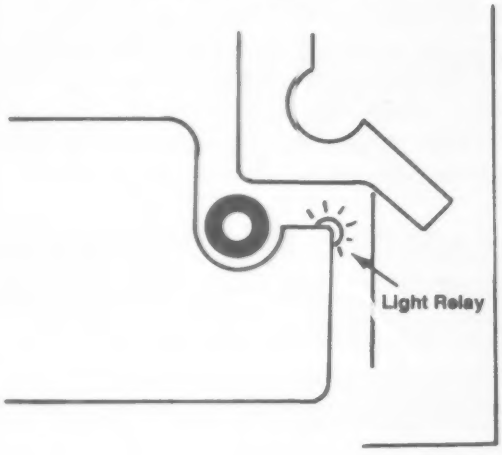
Wire Tape Guide Repair

To fix this, carefully bend back the wire tape guide with a pair of needle-nosed pliers. Make sure *THE VTR IS OFF* and the heads are stopped or you will break the heads for sure.

Freak Out No. 3

It originally begins as an extremely bizarre event. The VTR simply stops and starts for no apparent reason when shooting outside in the sunlight. You can walk in front of it and it will start and then stop when you move away from it. And of course, the machine worked perfectly in the studio 15 minutes ago. Reason: The lid must be on the portapak, otherwise the light sensitive automatic shut-off relay will be activated by sunlight to turn off and then turn on again when it is shaded.

AV-8400S Light Relay



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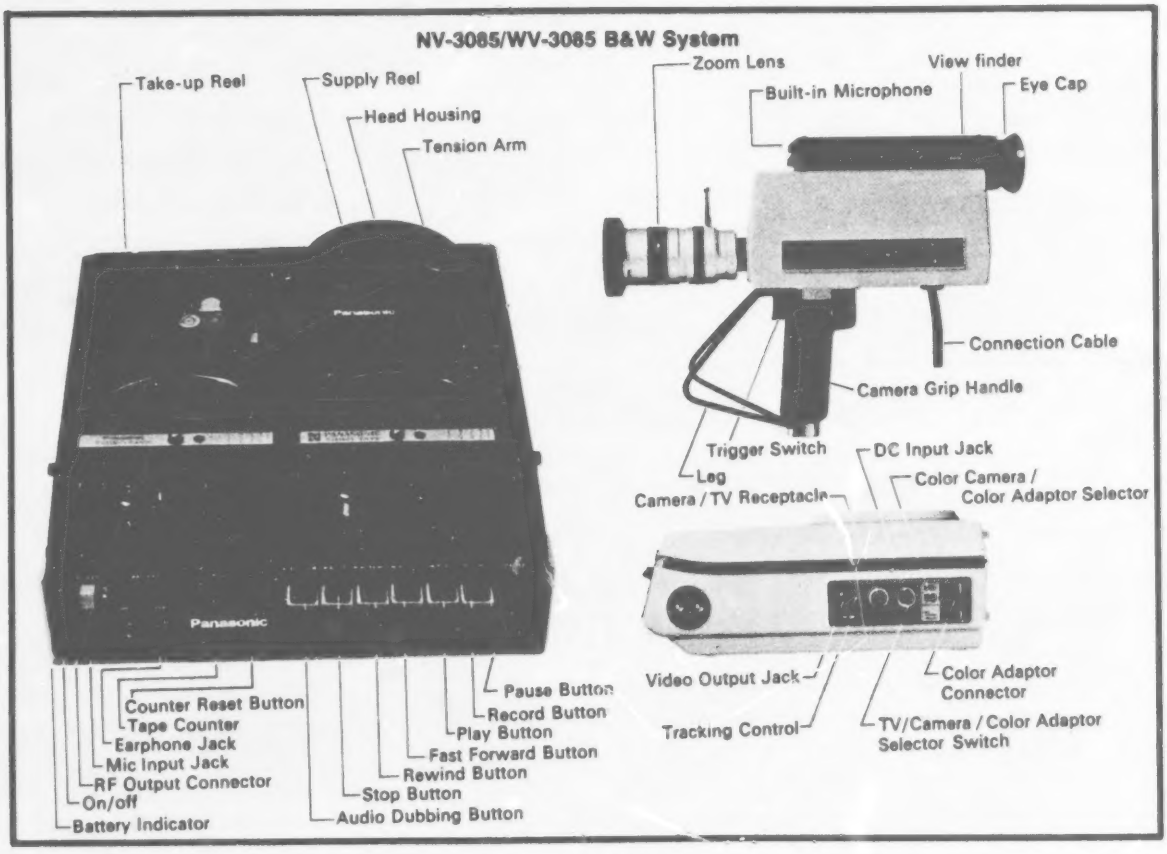
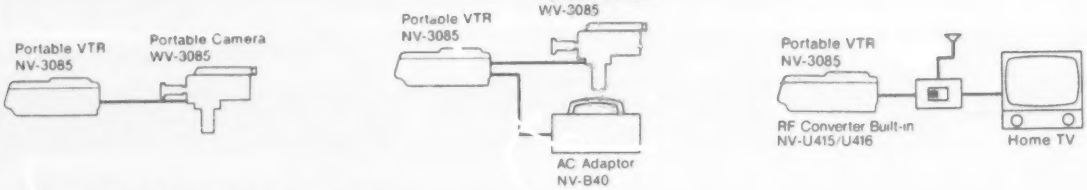
THE PANASONIC NV-3085/WV-3085 PORTABLE VIDEO SYSTEM

The Panasonic NV-3085 is a color adaptable, portable ½-inch reel-to-reel EIAJ VTR. It evolved from the earlier model NV-3082 b&w only VTR. The NV-3085 is an intelligently designed and easy to operate unit that has several advantages over the Sony units:

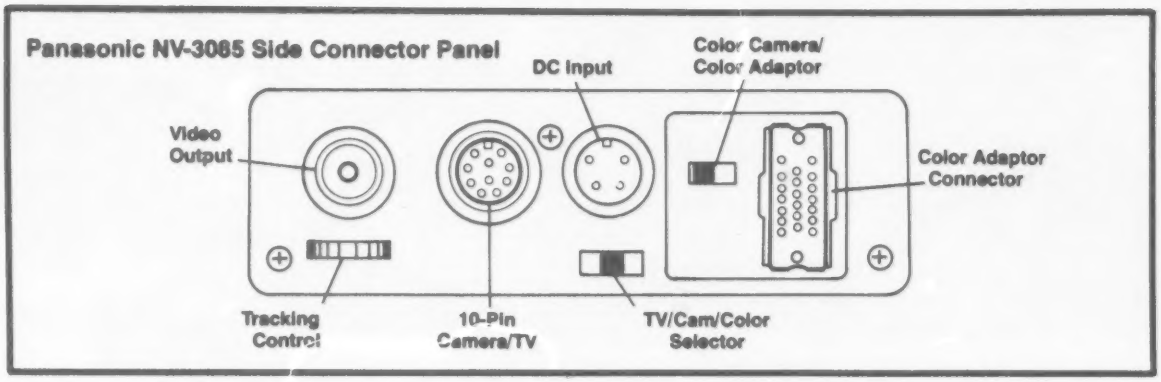
- Easy-threading design
- Simple push-button operation
- VTR head motor ON/OFF switch
- 1 hour recording time with Panaloid batteries
- Single color adaptable VTR
- Fast tape start-up
- Very good low light ability—5 footcandles
- Camera accepts Newvicon Tube
- Lightweight, easy to carry slim VTR design

However, the Panasonic VTRs seem to have frequent audio problems such as buzzing and hums in the sound track, and the picture quality is not quite as sharp as the portable Sony VTRs.





VTR-Camera Configurations



Battery Insertion

Two rechargeable Gel-Cell type Panaloid batteries (No. TY-355C) are inserted at the rear of the VTR. Make sure that the polarity (+ and -) is correct and that the battery ribbon is slightly exposed for easy removal.

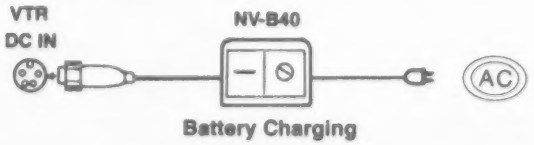
The battery meter should register in the GREEN ZONE for fully charged batteries. If the batteries fall below the minimum charge, the VTR will shut off. It takes about 8 hours to fully charge the batteries, and then they will provide about 60 minutes of operational recording and playback time.

Charging the Batteries

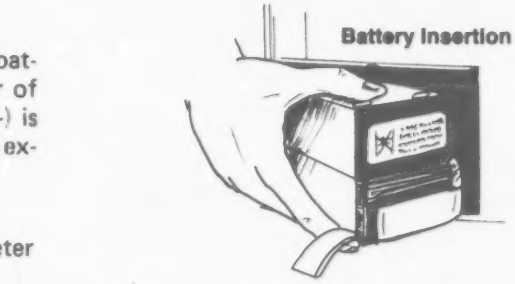
Insert the batteries into the VTR and plug the AC Charger unit (NV-B40) into the DC IN receptacle of the VTR and connect the charger to any AC power source. The charger will automatically charge the batteries and protect them from overcharging.

Other Power Sources

Since all portapaks operate on 12 Volts DC, a car cigarette lighter, a long-life battery, or a regular 12 Volt car or motorcycle battery can be used as an alternative power source. Be careful not to allow more than 12 Volts to power the VTR as this can burn out the power transistors and to repair them is very expensive. Therefore, use some kind of voltage regulator on your power source if possible.



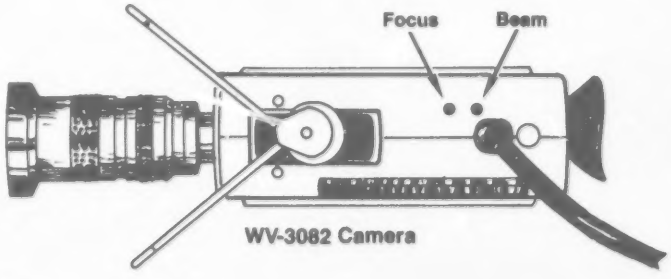
Battery Charging



NOTE: Once the VTR is turned *ON*, the batteries will run the camera and VTR for only 60 minutes *whether or not any recording is taking place*. Conserve your battery power by shutting off the VTR when not taping or monitoring.

Adjustment of B&W Camera

The WV-3085 camera has an external FOCUS and BEAM adjustment located underneath the camera body. Use a small screwdriver (jeweler's type) to turn the screws to achieve the best focus and picture contrast. *DO NOT* adjust these controls randomly. Once set they should stay in adjustment. First, be sure the lens focus and iris are properly set, and make sure the lighting conditions are optimum. Turn the FOCUS control to get the sharpest picture possible, and then adjust the BEAM control to obtain good blacks and whites and the reduction of any image lag.



WV-3082 Camera

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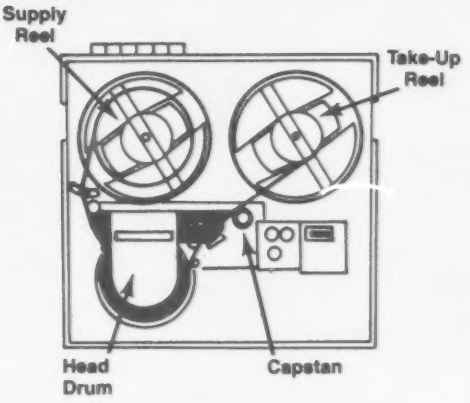
VTR and Camera Operation

Read the instruction manual.



Step 1 Open the VTR lid and thread the tape—see tape threading diagram on VTR.

Step 2 Thread the tape carefully and properly, and make sure the VTR is completely *OFF* and the video heads are *STOPPED.* Misthreading is the No. 1 cause for malfunction of the VTR.

Step 3 Plug the camera into the VTR. Use the CAMERA 10-Pin Plug.

Step 4 Make sure the INPUT SELECTOR switch is in the CAMERA position.

Step 5 Turn on the VTR POWER switch and wait for the camera to warm up.

Step 6 Depress the RECORD button and then the PLAY button. A picture should appear in the camera viewfinder.

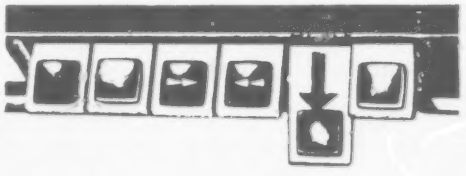
Step 7 Adjust the lens APERTURE, ZOOM, and FOCUS controls for the best picture.

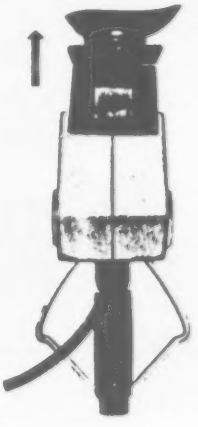
Step 8 To begin recording, pull the trigger switch on the camera. To stop recording, release the trigger switch.

Playback of Recorded Tape Through the Camera

Step 1 Rewind the tape to the starting point.

Step 2 Lift the eyecup on the camera viewfinder and push the PLAY button.

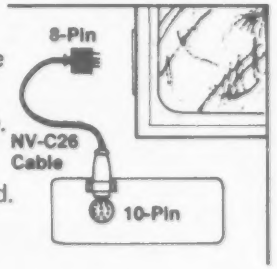




Step 3 Connect the headset of an earphone to the EARPHONE output on the VTR to monitor the sound.

Step 4 Adjust the TRACKING control on the side of the VTR if any distortion is present in the picture.

Playback Through a Monitor



Step 1 Connect the 10-Pin to 8-Pin TV monitor cable (NV-C26) to the VTR and monitor.

Step 2 Switch the INPUT SELECTOR on the monitor to the VTR mode.

Step 3 Depress the PLAY button on the VTR.

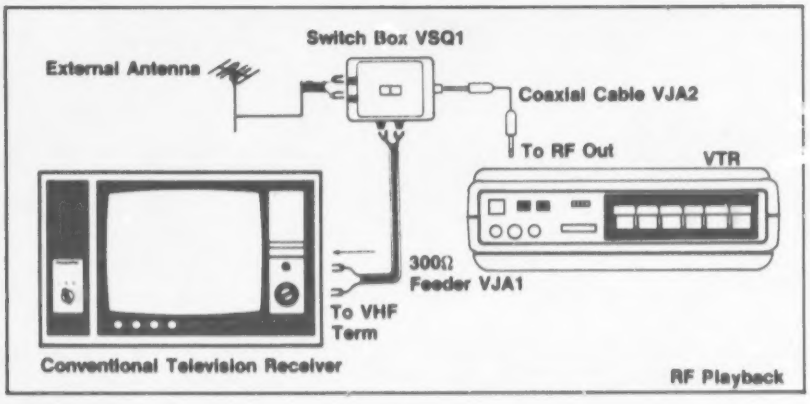
Step 4 Adjust the TRACKING control on the VTR if the picture is distorted.

Playback on a TV Set with an RF Adaptor

Step 1 Insert an RF Adaptor into the bottom of the VTR.

Step 2 Connect the mini-plug on the antenna converter to the RF OUT plug on the VTR.

Step 3 Connect the terminals on the antenna converter to the VHF terminals on the TV set.



Step 4 Place the VTR in PLAY mode and fine tune the TV set to the correct RF channel.

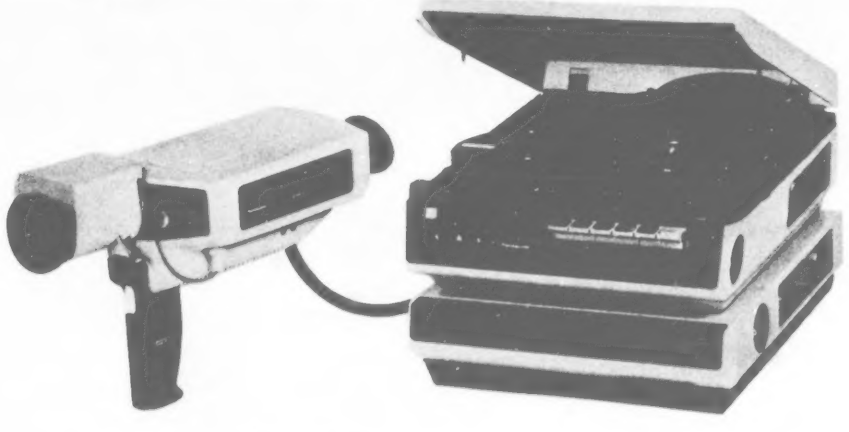
Step 5 Enjoy the program.

Panasonic WV-2200 Color Camera and CCU

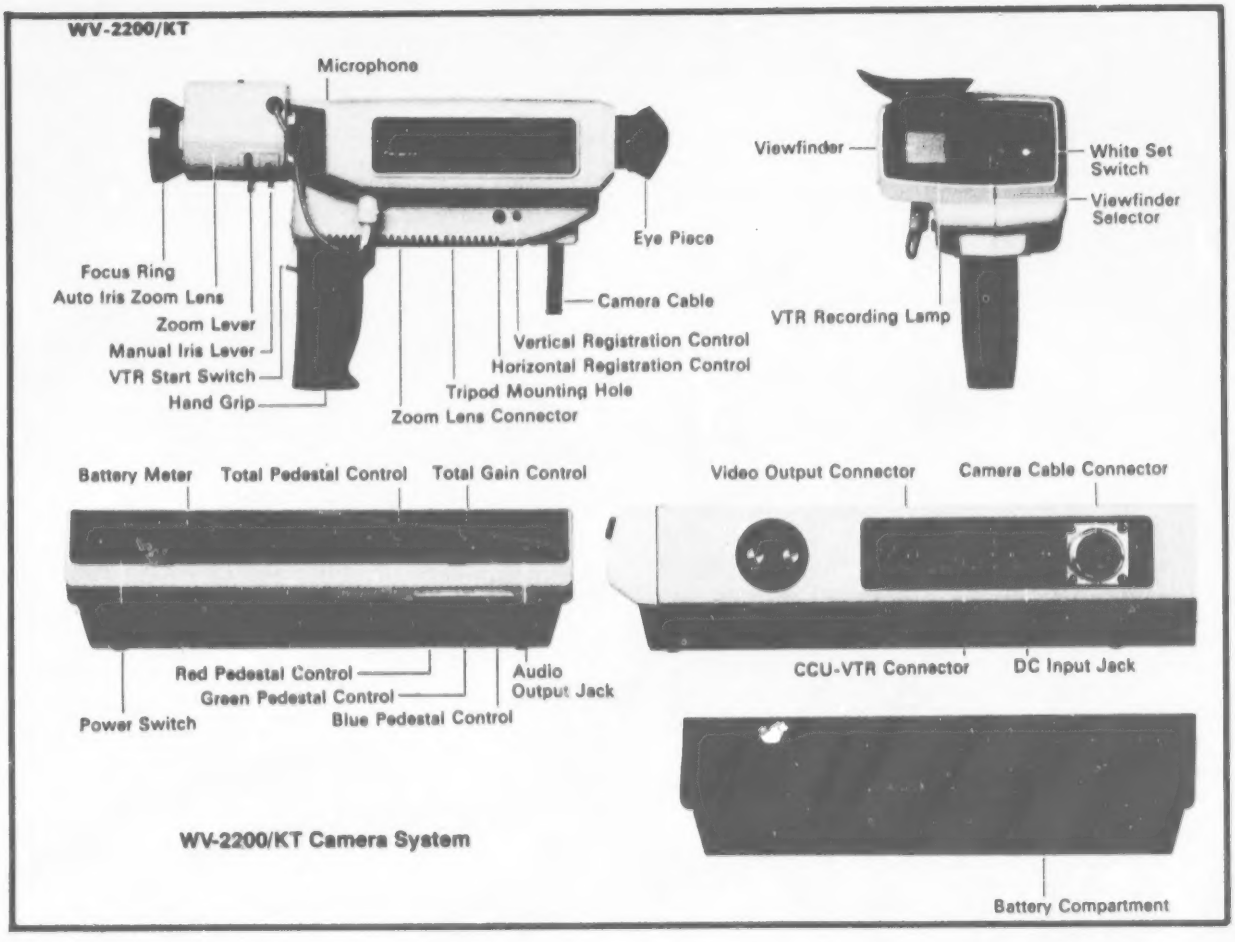
The Panasonic WV-2200 portable color camera is designed to operate with the NV-3085 VTR. The WV-2200 color camera requires the 11-pound WV-8400 camera control unit (CCU) for operation.

Features of the WV-2000 Color Camera:

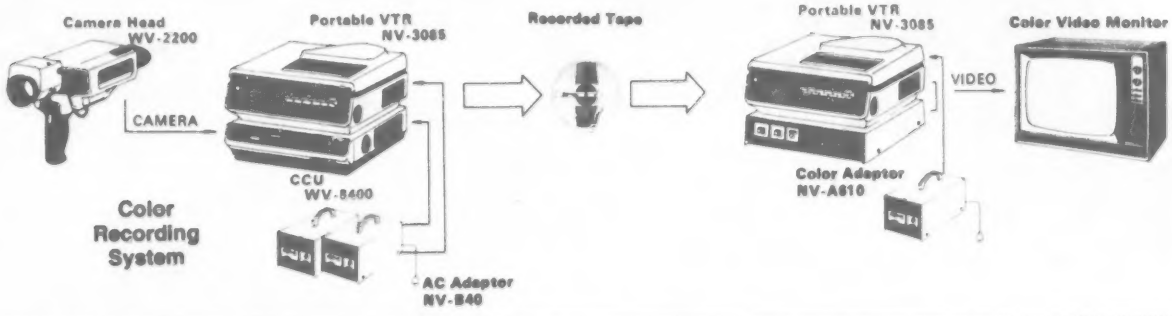
- Simple operation
- Automatic iris with Automatic Light Control (ALC) and MANUAL mode.
- Camera can operate on 50 footcandles
- 2-Vidicon tube pickup system with electrostatic focusing
- Built-in electret condenser microphone
- Automatic WHITE BALANCE and BLACK LEVEL controls
- CCU and VTR fit together in tandem



WV-2200KT



WV-2200/KT Camera System



Color Recording System

Sound Dubbing Procedure

New sound can be added to a prerecorded tape without erasing the picture:

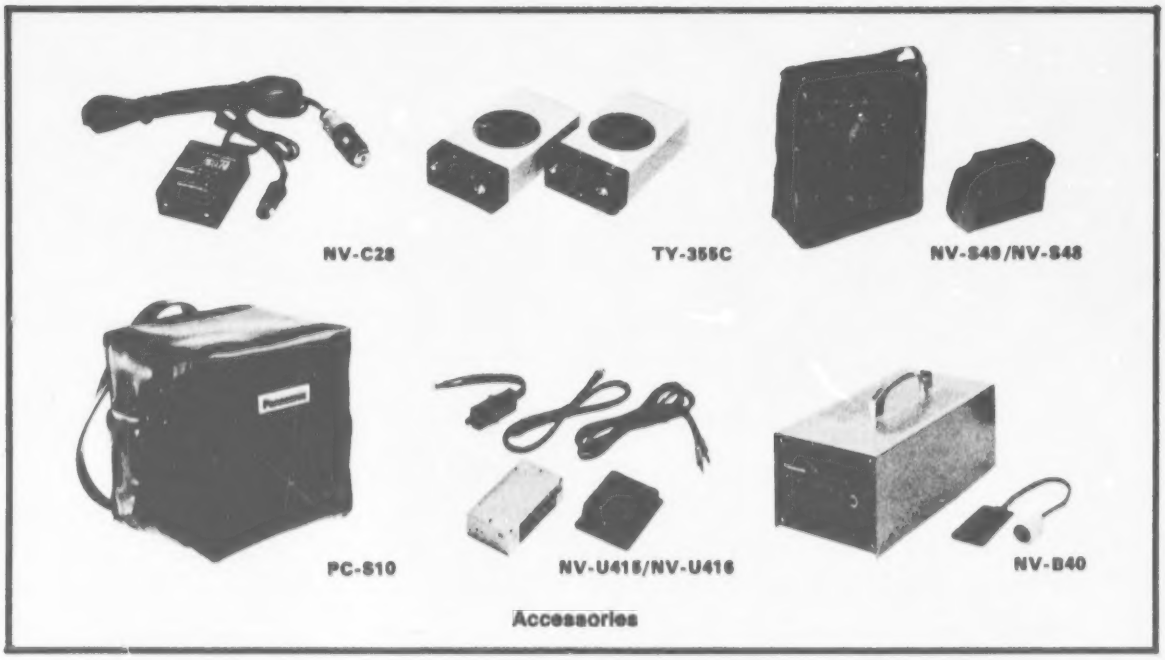
Step 1 Plug a microphone into the MIC input on the VTR.

Step 2 Play back the prerecorded tape.

Step 3 Depress the AUDIO DUB button at the point of the desired new sound.

Step 4 Depress the STOP button to complete the sound dub.

NOTE: The old sound is erased during the sound dub.



Accessories

Vital Accessories for Portapak Operation

- Carrying case for VTR and camera (NV-S49/NV-S48, PC-100 and PC-S10)
- External microphone
- 10-Pin cable camera extension
- Various microphone extension cables
- Extra batteries (TY-355C)
- Car battery cord (NV-C28)
- RF converter (NV-U415/U416)
- ND filter for color camera—ND0662 (½), ND0962 (1/8)
- Wide angle lens for b&w camera
- Headset for monitoring sound
- Fluid head tripod or shoulder brace

Portapak Precautions

DO NOT point the camera at the sun—instant burn.

DO NOT store the camera in a face down position. Be careful to store the camera in the case in a *horizontal* position, otherwise the flakes from the camera tube will settle on the tube face producing annoying black spots.

ALWAYS keep the camera and the lens clean and the lens CAPPED when not in use.

Other Nifty Accessories for Portable Video Systems

A Portable 2-Camera Switcher—2-camera "in-the-field production" is possible with the addition of a portable camera switcher. Several companies make small 2-pound hip mount camera switchers that cut, dissolve, superimpose and fade between 2 portable cameras.

Adwar Portable Color Switcher

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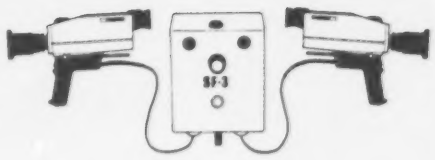
These unique switchers allow the camera viewfinders to serve as preview and program-out monitors; extend the camera cables to 100 feet; incorporate an intercom system and provide vertical interval switching and processing amplifiers. The optional equipment includes genlock, monitor jacks, a studio camera junction box and a non-portable VTR deck adaptor. B&W versions of the switcher are available from $395 to $495, and color versions are $995. Several companies provide these units.



MP Video Porta-Studio

ADWAR VIDEO
100 Fifth Avenue
New York, NY 10011

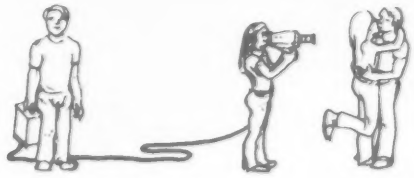
MP VIDEO
P.O. Box 96
Newton Upper Falls, MA 02164

Shoulder Mount VTR Carrying Systems

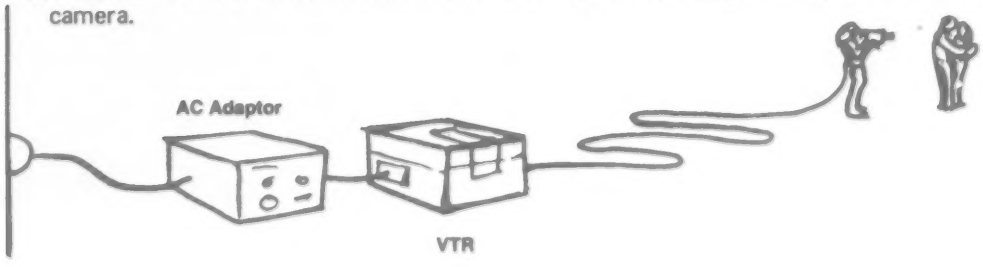
PORTAPAK PRODUCTION HINTS

The weight of the VTR and the camera can make it difficult to handle for long periods of time. There are several alternatives:

- Use two people—one to carry the VTR and one to carry the camera.



- Use the 32 foot 10-Pin camera extension cable (CCJ-10) and just carry around the camera.



- Use a back-pack system for carrying the VTR and CCU. You can make one yourself with any simple back-pack frame that has a ledge on it. Use quick release straps and mount the VTR on its side so the operator can reach the controls.

Sound Considerations

- Use a good quality low-impedance unidirectional external microphone. This will improve your sound considerably. The SENNHEISER shotgun microphones are the best but are expensive—$200 - $800.
- *Always* check and monitor your sound with a good set of sensitive headphones so buzzes, hums, clicks and wind noise can be noticed.
- *Always* use wind filters on mics when shooting outdoors.

Lighting Considerations

- *Always* keep your camera adjusted properly, and be sure the lens and the vidicon tube are clean. Additional lights should be used indoors for added picture crispness and sharpness.
- Make videotape tests outdoors with various lens "f" stop settings (lens aperture) to determine how to get the best contrast and sharpness in your picture.

ABSOLUTE VIDEO MAXIM NO. 1—ALWAYS MAKE A TEST RECORDING FIRST!

Take the time—it only requires a few seconds for a test recording and playback. 30 seconds for a test is a lot less painful than a totally useless 30 minute tape that you spent all day and lots of money shooting.

ABSOLUTE VIDEO MAXIM NO. 2—YOU CAN'T PRE-CHECK AND PRE-TEST TOO MUCH!

Electronic Stability

Play your tapes on other similar VTRs, and also check for tracking compatibility and picture stability on several different monitors. Keep all the recording and playback heads and tape guides *perfectly clean*. Have your VTR aligned annually at the factory/head service center if possible and occasionally checked with the manufacturer's STANDARD TAPE if practical. If you are planning to edit your tapes, always run your tapes at least 10 seconds before the beginning and at the end of each scene to allow for optimum sync stability and "lock up." Make sure the SKEW control is adjusted perfectly on your VTR during tape playback.

Working with Portable Video Systems

When you "go portable," you will soon find yourself immersed in a gray spaghetti of wires, cables, black boxes, CCUs, microphones, and batteries. Try to keep it simple and take along some help (gaffers and grips) to keep track of everything. The one-man/one-woman total recording system may be a great ego trip, but it's also a lot of extra work, and the margin for error is too great. It's easy to forget things.

Try to organize a tight crew that works well together and has respect for one another. You can all make beautiful pictures collectively. A compatible crew can be a powerfully personal and artistic experience, and everyone can enjoy the highly rewarding feeling of a successful video production.

Chapter 13
ENG And Portable Videocassette Systems

What has now come to be known as EJ (Electronic Journalism), ENG (Electronic News Gathering) and EFP (Electronic Field Production) could be described as technological jargon for the video version of the traditional film style single-camera system approach to program production. Ironically, early video enthusiasts used this technique with their simple black-and-white portapaks years ago. It seems that by 1975, broadcast TV had finally caught up with the pre-1970 videofreaks.

How It Came About

Monster cameras and VTRs were necessary, because over-the-air broadcasting required such a high degree of technical quality, such large studios and enormous amounts of light. Portable video on this level meant tractor trailer trucks and crews of 20 people! Then several key technological developments took place that changed all this:

- *The introduction of the portable Videocassette Recorder (VCR).* In 1975 Sony introduced the world's first portable ¾-inch U-Matic VCR, the VO-3800. Now, a good quality, easy-to-use VTR existed that was super cheap by broadcaster's standards.
- *The development of the DIGITAL TIME BASE CORRECTOR.* The small-format ¾-inch VCRs were useless to broadcasters because they used the heterodyne color system and were much too unstable mechanically to be used for direct over-the-air broadcasting. But the digital TBC is able to correct the inherent limitations of nonbroadcast helical scan VTRs. Now there were no longer any technical barriers to the use of nearly any VTR for broadcast purposes. It's as if someone finally figured out how to make the wheel round.
- *Introduction of low-cost, hand-held color cameras:* Until the mid 70's, all color video cameras were bulky, very expensive, and much too complex and delicate for field use. A "cheap" color camera weighed 100 lbs. and cost $60,000. Then, single tube cameras were introduced that produced surprisingly good color for under $5,000, and the big rush was on. The industry standard camera tube—the Philips PLUMBICON was reduced in size to 2/3 inch and other high quality tubes such as the Chalnicon tube and the Saticon tube were integrated into compact cameras that utilized professional 16 m/m design features. Excellent 3-tube studio quality portable cameras were soon on the market that weighed under 25 lbs. and cost from $12,000 to $35,000. The broadcasters now had their cheap $35,000 camera and the CCTV/educational/industrial/independent people had their cheap $5,000 camera. Color portable video could now really flourish and evolve.
- *Computerized Videocassette Editing:* Of lesser significance historically but of equal importance technologically was the perfection of rapid computerized editing systems for videocassettes. Computerized editing has been around for a long time with the big studio 2-inch quads, but only recently had it been adapted and redesigned to work with small-format videocassette systems. Computerized editing made it possible to edit videocassettes quickly in the field or in the studio with as much accuracy and sophistication as film editing. Of course, with the elimination of the film processing time and expense, the advantage of video for news gathering became very attractive. With the addition of

portable TIME CODE GENERATORS to portable VCRs, it became possible to electronically number and reference each frame of video as it was being shot in the field, so the video material could be edited as soon as the scene was finished.

- *Broadcaster-forced technological sophistication:* As the broadcasters gobbled up the ¾-inch videocassette systems by the dozens, it didn't take long for them to start complaining about how these systems weren't really designed for their purposes—which was true. Broadcast engineers take certain technical standards for granted when they pay $60,000 to $120,000 for a VTR. It's unrealistic to expect a $6,000 or $3,000 VTR to supply the same kind of quality features.

Time Base Corrector (BVT-1000)

Sony, in particular, was taken completely by surprise by the broadcaster's rush to the ¾-inch equipment. According to Sony, the VO-3800 portable VCR and the VO-2850 editing VCR were intended solely for use by educational/industrial/and Cable TV people. For this reason, many features of the units such as audio and video plugs, audio impedances, color controls, batteries, etc., were all wrong or inadequate for the broadcaster's purposes.

So, the Japanese engineers frantically rushed back to their drawing boards and came up with a new series of broadcast ¾-inch VTRs, TBCs and cameras that would meet the particular demands of the broadcasters. Sony calls its broadcast line the BV SERIES.

Practicality of ENG Systems

Although portable video equipment is rapidly replacing film equipment for much of the news gathering on most TV stations, portable video equipment still needs much evolution.

WEIGHT—A top quality portable ENG video camera weighs between 15 and 24 pounds with battery pack, 10:1 zoom lens and electronic viewfinder. The VTR adds another 24 pounds. Usually a strong two person crew can deal with this quite conviniently if one person carries the camera and the other person carries the VTR. A comparable 16mm film camera system would weigh about 42 pounds.

LIGHT—Nearly all video cameras take great pictures in daylight, but many models, especially the under $6,000 variety, do not work as well in less than 80 to 100 footcandles, which means 3 or 4 700 Watt Quartz lights will be needed for indoor shooting.

Videocassette Editor (BVU-200)

DEPENDABILITY—Back up systems are always required for crucial video recording. This raises production and hardware costs considerably.

COSTS—Initial investment in a video ENG system including a truck and editing equipment could run from $100,000 to $300,000 per unit. Compare this to $20,000 to $50,000 for a 16 mm camera and film processing unit and editing equipment. On the other hand, the video investment is *one time only*, and the videotape can be reused many times. Film stock is very expensive and must be constantly purchased, and of course, processed every time it is used.

TIME—The Great Equalizer—A video camera's picture can be microwaved immediately back to the studio and transmitted live over-the-air. If this is important, there is no other choice but to go video.

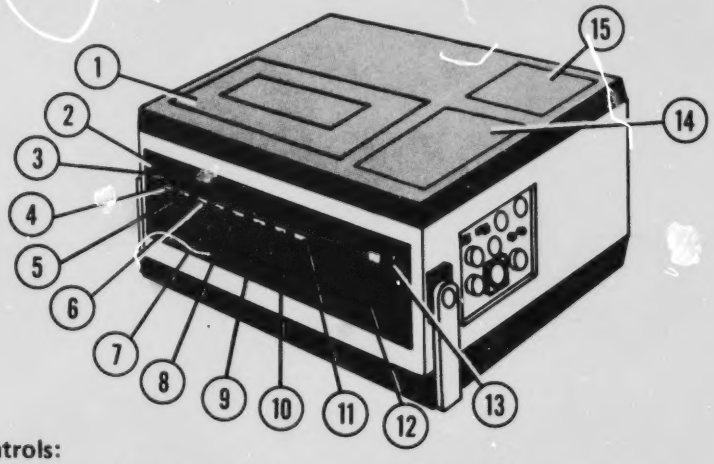
POPULAR PORTABLE VIDEOCASSETTE RECORDING SYSTEMS

The Sony VO-3800 VCR

The original ¾-inch portable system that started the ENG gold rush is the Sony VO-3800. It's a good quality VCR that uses compact ¾-inch KCS type 20 minute videocassettes and records and plays back NTSC color. Color playback requires connection with the AC-3000 AC Power Adaptor.

Features:

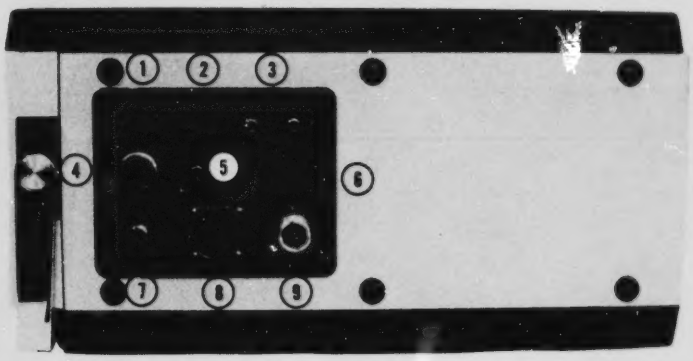
- U-Matic standard Videocassette (no threading) interchangeable with any ¾-inch U-Matic VCR regardless of size.
- Weighs 30 lbs. with battery.
- Operates on any 12 volt DC power source or 120 volts AC.
- Internal battery pack recharges in a few hours and provides 1 hour of recording time.
- Tape can be removed without rewinding.
- Full pushbutton operation.
- Operates from 32°F to 104°F.
- Still frame and Pause mode.
- Compatible with most color or b&w cameras.
- Built-in dropout compensator.
- Internal sync generator.
- Stereo sound—2 audio tracks.



VO-3800 Controls:

1. VIDEOCASSETTE COMPARTMENT—Push EJECT and compartment will pop up. Insert a KCS type cassette here.
2. TAPE COUNTER—Shows amount of tape used.
3. TAPE COUNTER RESET BUTTON—Push to 000 at the start of the tape.
4. CASSETTE *EJECT* BUTTON—Push to remove or insert the cassette.
5. FAST FORWARD (*F FWD*) BUTTON—Advances the tape rapidly.
6. PLAY or FORWARD (*FWD*) BUTTON—Moves the tape at normal speed.
7. *STOP* BUTTON—Stops the tape.
8. *REW* IND BUTTON—Rewinds the tape.
9. *REC*ORD BUTTON—Push to monitor (E to E) picture and sound. Push simultaneously with FWD button to start the recording.
10. *AUDIO DUB*—Allows sound to be added later.
11. *PAUSE* CONTROL—Allows a single frame display and stops the tape during recording.
12. *TRACKING* CONTROL—Compensates for recording variations in tapes made on other VTRs. Adjust for the best picture during playback.
13. *BATTERY* LEVEL METER—Shows the condition of the internal BP-20A battery. The needle should be in the white zone.

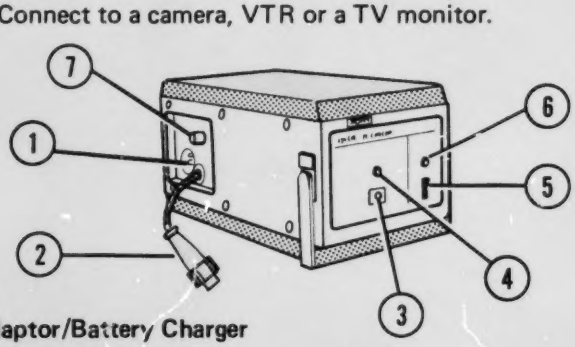
14. BATTERY COMPARTMENT—Place a BP-20A battery in here.
15. RF UNIT COMPARTMENT—An optional RF Adaptor can be purchased which will permit VTR playback on any ordinary TV set. The playback will be in b&w only unless the AC-3000 AC power adaptor is connected.



VO-3800 Side Panel—Plugs and Connectors

1. MODE SELECTOR—*COLOR* or *B&W*—Select the correct mode for recording or playback.
2. AUDIO TRACK SELECTOR—Select *CH*-1, *CH*-2, or *MIX* (both tracks).
3. *MIC*ROPHONE INPUTS—Use 1 or 2 microphones with mini plugs.
4. *CAMERA/TV*—for recording—Connect to a camera, CCU or TV monitor/receiver. For playback—Connect to a TV monitor.
5. *EARPHONE* PLUG—Use for monitoring sound. Use a Sennheiser headset Model HD-414 or equivalent.
6. *LINE OUT*—Connect to an auxiliary stereo amplifying system, editing VTR or TV monitor.
7. *RF OUT*—Connect to the VHF terminals of any TV set.

   NOTE: The optional RF Adaptor must be installed inside the VCR. The AC-3000 Power Adaptor must be connected and turned ON for color playback.
8. *AC ADAPTOR* MULTI-PIN PLUG—Connect to the AC-3000 Power Adaptor/battery charger. The AC-3000 provides AC power, charges the battery inside the VCR and provides color playback circuitry.
9. *VIDEO IN*—Connect to a camera, VTR or a TV monitor.



AC-3000 AC Adaptor/Battery Charger

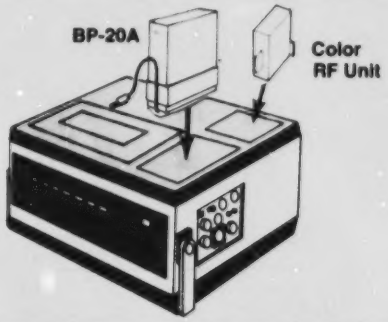
1. *AC IN*PUT—Connect an AC power cord here.
2. MULTI-PIN PLUG AND CABLE—Connect to the AC Adaptor plug on the VO-3800 VCR.
3. *BATTERY* JACK—Use for charging a second BP-20A battery.
4. PILOT LAMP—Indicates the battery is charging.
5. *POWER* SWITCH—Turns unit ON.
6. PILOT LAMP—Indicates the unit is ON.
7. *VIDEO OUT*—Connect to an editing VTR or a TV monitor.

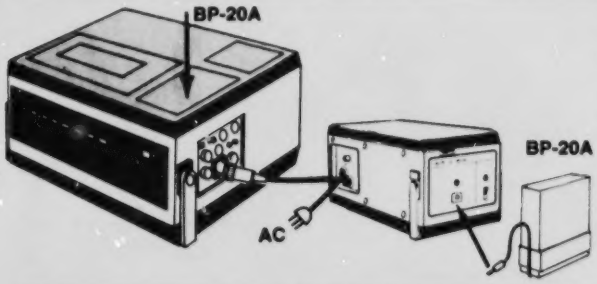
Power Sources

The VO-3800 will operate for 1 hour on its internal BP-20A battery or on AC Power by connecting the AC-3000.

Insertion of Battery and RF Adaptor:

Open the top panels and insert the battery and optional RF Adaptor.





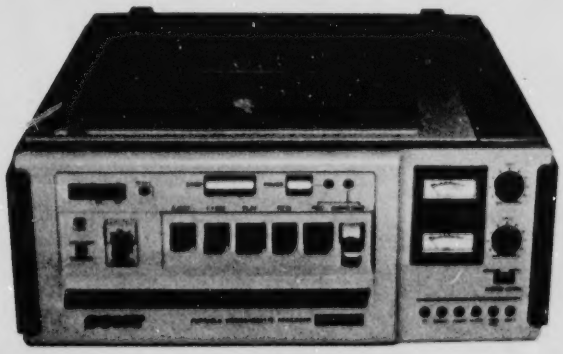
Battery Charging

The internal battery can be charged while inside the VO-3800 simply by connecting the AC-3000 to the VCR unit. A second BP-20A can be charged by connecting it to the auxiliary BATTERY plug on the front panel of the AC-3000.

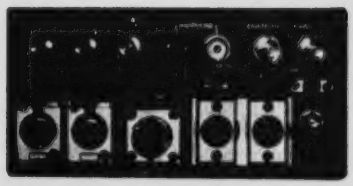
VO-3800 AC Operation and Battery Charging

Sony Portable Broadcast Videocassette Recorders

Sony has created a line of sophisticated ¾-inch portable U-Matic VCRs specifically designed for broadcasting applications. They include the discontinued BVU-100 recorder/player and the newer BVU-110 recorder/player successor and the BVU-50 record-only VCR.



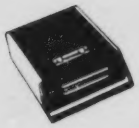
BVU-110



BVU-110 (side panel)

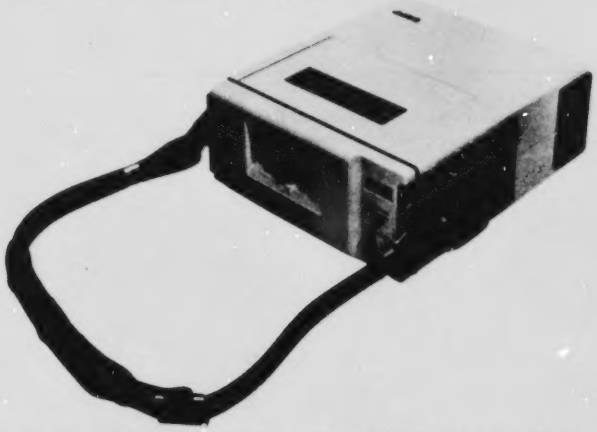
The BVU-110 Features:

- Built-in color playback ability
- Optional plug-in card SMPTE time code generator
- Low power consumption – only 11.6 watts
- Built-in Ni-Cad battery provides 5 hours of operation on a single charge
- Electronic LED timer display for either tape time or SMPTE time code
- High-speed visual picture search in Fast-Forward or Rewind with monitor lock for stability
- Full metering and status indicators
- Dual audio metering
- Flying RF confidence heads



- Servo-lock and tape and battery end warning indicators.
- Automatic back space editing
- TBC connectors
- AGC/manual audio controls
- Broadcast video and audio connectors
- Two video outputs
- 14-Pin CCQ camera input
- Weight – 24 lbs. with battery and cassette
- Price is $4,995

The BVU-50



Developed to be a sister machine to the BVU-100, the BVU-50 weighs only 15 lbs and offers a handling ease and operating efficiency not possible with the more complex and heavier recorder/players. The BVU-50 costs about $3,500.

Its features include:

- Low power consumption–3 hours recording with Ni-Cad battery
- High performance–45 db
- Gyroscope error suppression with stiff servo correction
- Assemble edit capability
- Manual/Limiter audio control
- Framing servo
- SMPTE address track
- Real-time display–minutes and seconds

POPULAR PORTABLE COLOR VIDEO CAMERAS

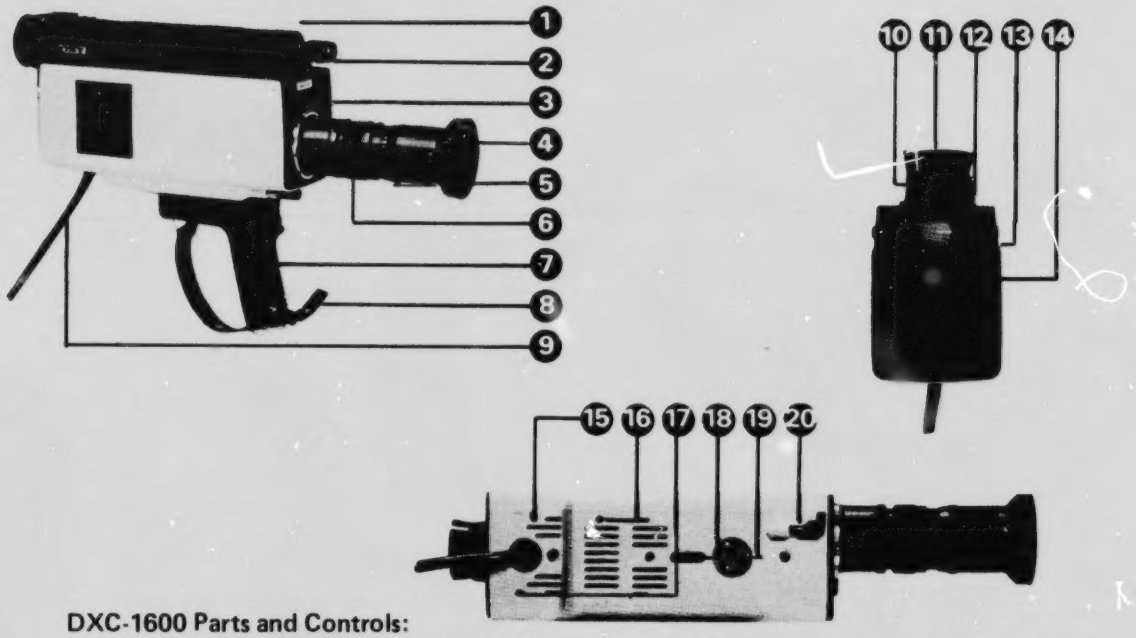
Sony DXC-1600 Portable Trinicon Color Camera

The DXC-1600 is a single-tube, high-resolution (for a single tube camera) color camera that will operate from any 12 volt DC power source or standard AC power using the AC-1600 power adaptor.

Features:

- Horizontal Resolution–300 lines at center
- Minimum illumination–25 footcandles; optimum–more than 150 footcandles.
- 60 minutes of continuous operation with the BP-20A battery
- Built-in electret omnidirectional condenser microphone
- Built-in color conversion filter wheel
- Built-in image enhancer
- Viewfinder indicators show the battery condition and VTR start/stop
- Adjustable White Balance
- Automatic/Manual control of video level, pedestal and chroma controls
- Weight–Camera and lens–8.3 lbs; CCU and Battery–12 lbs.
- Camera can be operated on internal or external sync
- Full NTSC color output

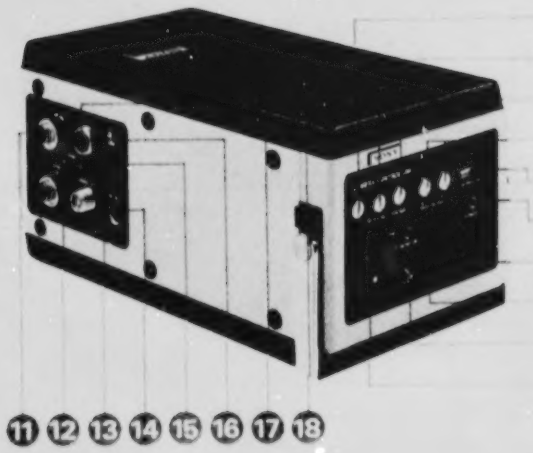
DXC-1600



DXC-1600 Parts and Controls:

1. COLOR TEMPERATURE CONVERSION FILTER—Adjust for the proper lighting. See filter chart on the camera.
2. MICROPHONE—Omnidirectional.
3. LENS APERTURE—Adjust for the best light.
4. LENS HOOD—Protects the lens. Keep on when the camera is not in use.
5. FOCUS RING—Adjust for the best focus.
6. ZOOM RING—Controls the zoom—12.5 to 85 mm (6:1).
7. GRIP TRIGGER SWITCH—Turns the camera ON or OFF.
8. HANDGRIP—Detaches for tripod mounting.
9. CAMERA CABLE—10-Pin (CCJ cable).
10. EYEPIECE—Flips up for viewing playback in viewfinder.
11. EYE CUP for camera viewfinder.
12. ELECTRONIC VIEWFINDER—Allows RECORD mode monitoring and playback of picture from the VTR.
13. RECORD LAMP—Light illuminates when the VTR is *ON.*
14. BATTERY CHECK LAMP—Flashes when the battery is weak and there is 10 minutes of recording time left. A steady glow indicates *complete discharge* of the battery. *DO NOT* continue to operate the camera when the battery is discharged.
15. VIEWFINDER *BRIGHTNESS* CONTROL—Adjust with a small screwdriver.
16. VIEWFINDER *CONTRAST* CONTROL—Adjust with a small screwdriver—does not affect the picture being recorded.
17. *ELECTRICAL FOCUS* CONTROL—*See Electrical Focus Adjust—p. 198.*
18. GRIP SWITCH—Triggers ON/OFF switch.
19. TRIPOD RECEPTACLE—Connect to any tripod.
20. AUXILIARY START/STOP BUTTON—Starts and stops VCR.

DXC-1600 CCU



DXC-1600 Camera Control Unit

1. Video LEVEL MANUAL control
2. PEDESTAL control
3. CHROMA control
4. B R WHITE BALANCE control
5. WHITE BALance meter
6. Pilot lamp
7. POWER switch
8. VF MONITOR lamp
9. VF MONITOR switch
10. Video LEVEL AUTO MANUAL switch
11. SYNC INput connector
12. VTR connector
13. VIDEO OUTput connector
14. DC INput connector
15. SYNC ON OFF switch
16. MIC OUTput jack
17. CAMERA HEAD connector
18. Battery compartment

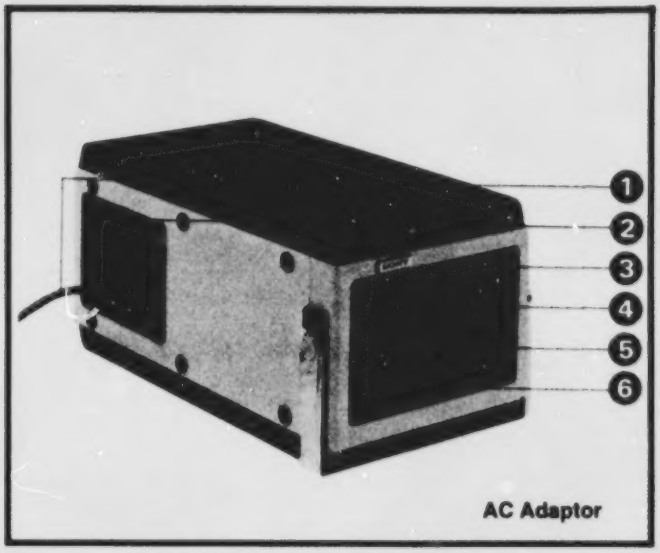
DXC-1600 CCU Controls

1. VIDEO *LEVEL MANUAL* CONTROL--Adjusts the video level. Generally use the AUTOmatic mode.
2. *PEDESTAL* CONTROL—Adjusts the level of BLACK (as related to the contrast in the picture). The control should usually be left in the center detent position.
3. *CHROMA*—Controls the color saturation. This control should generally remain in the center detent position.
4. *B/R WHITE BAL*ANCE CONTROL—See White Balance set.
5. *WHITE BAL*ANCE METER—See White Balance set.
6. PILOT LAMP—Indicates the CCU is ON.
7. *POWER* SWITCH
8. *VF MONITOR* LAMP—Indicates the viewfinder is in the VCR playback mode.
9. *VF MONITOR* SWITCH—Switches the viewfinder to VCR playback mode.
10. VIDEO *LEVEL AUTO/MANUAL* SWITCH—Selects AUTO or MANUAL video level mode. Generally use the AUTO mode.

DXC-1600 Plugs and Connectors

11. *SYNC* INPUT—Use when the camera is operated with an external sync generator and/or multiple camera SEG system.
12. *VTR* CONNECTOR—Use the 10-Pin cable to connect to a portable VTR (AV-8400S or VO-3800).
13. *VIDEO* OUTPUT PLUG—Produces NTSC color composite video. Connect to any VTR or monitor.
14. *DC IN*—Input for a 12-volt DC battery or the AC-1600 AC Power Adaptor.
15. *SYNC ON/OFF* SWITCH—Turns the sync ON or OFF. CCU automatically switches from internal to external sync.
16. *MIC OUT* PLUG—An auxiliary camera microphone output. Use to monitor sound.
17. *CAMERA HEAD*—Connect to DXC-1600 camera with a 10-Pin cable.
18. *BATTERY* COMPARTMENT—Insert the BP-20A battery here.

    NOTE: The battery can be charged while inside the VCR.



AC Adaptor

AC-1600 AC Power Adaptor

1. 4-PIN POWER SUPPLY CORD—Connect to DC IN on CCU.
2. *AC IN*PUT—Connect the AC power cord here.
3. *CHARGING* LAMP—Indicates the battery is charging.
4. PILOT LAMP—Indicates the unit is ON.
5. *POWER* SWITCH
6. *BATTERY* JACK—Use for charging a second BP-20A Battery.

Power Sources

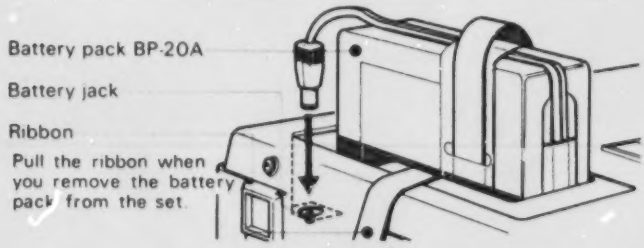
Like most portable video cameras, the DXC-1600 can be operated on any stable 12 Volt DC source. It can also operate on AC Power with the AC-1600 power adaptor.

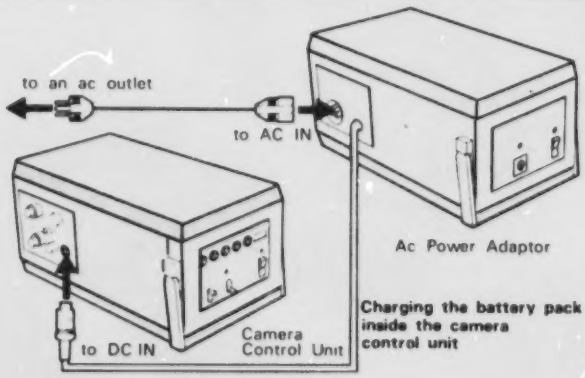
Battery Power

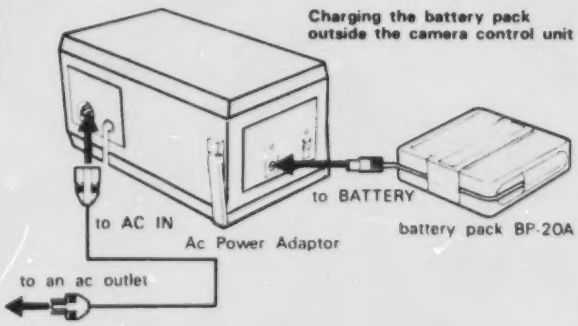
Insert the BP-20A battery into the CCU compartment. The battery can be charged while inside the CCU. A fully charged battery will allow 60 minutes of operation at normal temperature. The red light in the viewfinder (left side) will flash when the battery has about 10 minutes left. A steady glow indicates complete discharge.

NOTE: This is the opposite process of the AVC-3450 camera.

CAUTION: *DO NOT* permit the battery to remain discharged. Recharge at once.




to an ac outlet
to AC IN
Ac Power Adaptor
to DC IN
Camera Control Unit
Charging the battery pack inside the camera control unit


Charging the battery pack outside the camera control unit
to BATTERY
battery pack BP-20A
to AC IN
Ac Power Adaptor
to an ac outlet

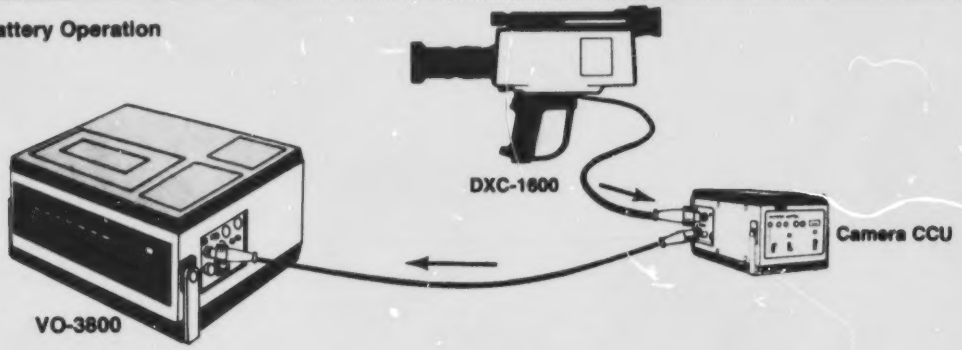
Charging Procedure

Step 1 If the battery is inside the CCU, connect the AC Adaptor/Battery charger to the CCU with the 4-Pin plug (DC IN).

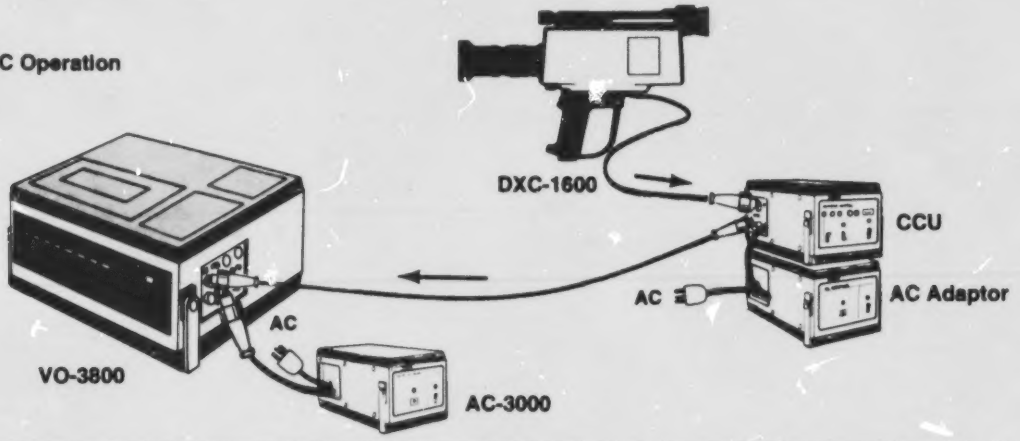
Step 2 Plug the AC Adaptor into a standard AC power source and turn on the AC Adaptor. If the battery is outside the CCU or if you want to charge a second battery, plug it into the BATTERY Jack of the AC Adaptor. When charging the batteries, the charging lamp will light and then go out when the charging has stopped. A full charge requires 3 hours for 1 battery and 6 hours for 2 batteries.

NOTE: The Power switch on the CCU should be *OFF* when charging the batteries.

Battery Operation



AC Operation



CAMERA SET UP AND RECORDING PROCEDURE

Step 1 Connect the camera to the CCU and the CCU to the VTR.

Step 2 Make sure both the battery in the CCU and in the VO-3800 are fully charged for DC operation.

Step 3 Turn on the CCU power switch. Turn on both AC Adaptors if operating on AC power. Indicator lamps will light.

Step 4 Set the VF MONITOR switch on the CCU to CAMERA.

Step 5 Set the Video LEVEL control on the CCU to AUTO position.

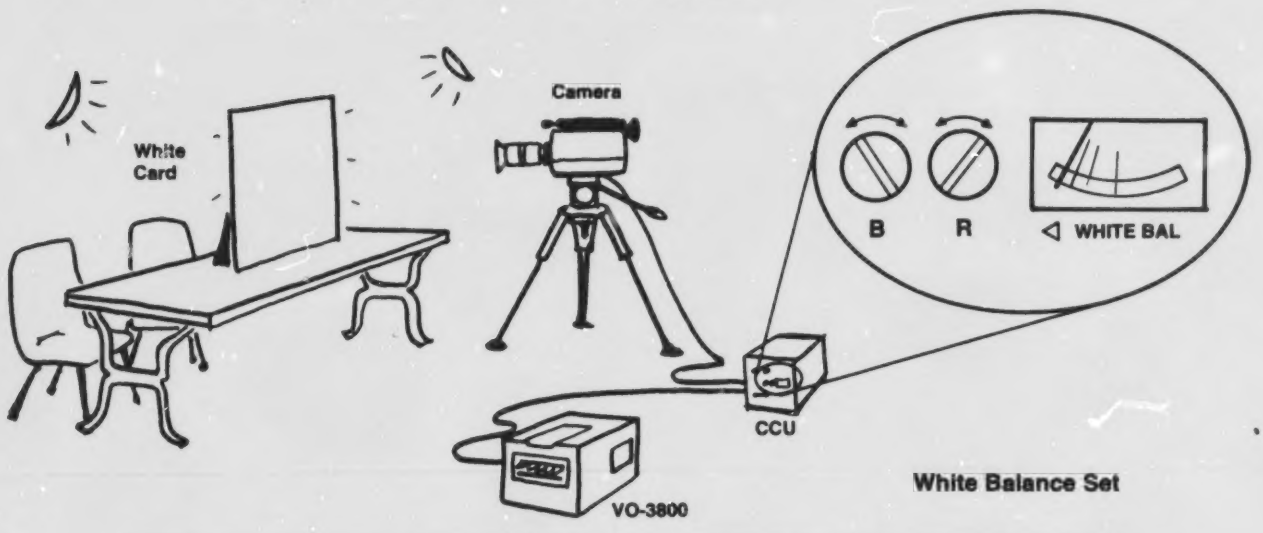
Step 6 Set the PEDESTAL and CHROMA screws on the CCU to their center position.

Step 7 Set the correct color conversion filter. Refer to the chart on the rear of the camera and select the correct color filter for the dominant lighting conditions.

Adjust for Correct Filter	
Color temperature conversion filter	Lighting Conditions
1	Iodine lamps, sunrise & sunset (3200°K)
2	Fluorescent lamps
3	Bright outdoors
4	Cloudy and rainy

Step 8 Adjust the White Balance: The camera needs something constant to reference to, so a white card is used. If the camera can properly reproduce white under the prevailing light conditions, all the colors will be correct. Set up a large white card where the subject is to stand and turn on all your lights if shooting indoors. Adjust the lens for the proper aperture, focus, and then zoom into the white card.

Turn the B/R WHITE BALance control screws in either direction so the WHITE BALance meter swings to the LEFT as far as possible.



White Balance Set

> **NOTE:** Once the White Balance and the filter are set for the prevailing light, the White Balance shouldn't need any readjusting unless the lighting conditions change. If you set the filter and White Balance indoors and go outside, the filter will have to be changed and the White Balance reset for daylight.

Step 9 Make sure the VTR mode switch is in the COLOR position.

Step 10 Load the tape into the VTR, place it in the RECORD mode and begin shooting. The red lamp on the right side of the camera should come on when the camera trigger switch is pressed—indicating the VTR is running. The light will go off when the VTR is stopped. Monitor the sound through the VTR earphone jack.

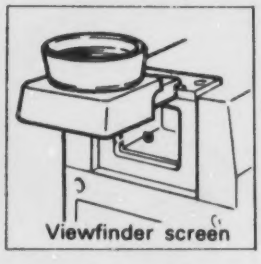
Picture Playback through Camera Viewfinder

Step 1 Set the VF MONITOR switch on the CCU to VTR. The VF MONITOR lamp will light.

Step 2 Raise the eyepiece of the camera for easy viewing.

Step 3 Close the lens to the *C* position to protect the tube from burns.

Step 4 Place the VTR in the PLAYBACK mode. CCU and camera must be connected to VTR. Use headsets or earphone to hear the sound.



Special Camera Adjustments

Manual Video Level Adjustment:

Adjust the picture in the MANUAL mode to match the viewfinder picture in the AUTO mode. Change the LEVEL switch on the CCU back and forth between AUTO and MANUAL, and adjust the control until the brightness and contrast of the scene is the same in both modes.

Electrical Focus Adjustment:

If the color is lost or a herringbone pattern is apparent in the color picture

Step 1 Point the camera toward a colored subject.

Step 2 Adjust the lens focus and the light for the best picture.

Step 3 Watch the WHITE BALance meter and turn the electrical focus control screw on the bottom of the camera with a small screwdriver until the needle on the meter swings to the RIGHT as far as possible.

If this doesn't work, try Plan B:

Step 1 Set the needle of the WHITE BALance meter to the CENTER position by turning the CHROMA control screw on the CCU to the *left*.

Step 2 Readjust the ELECTRICAL FOCUS screw.

Step 3 Reset the CHROMA control screw to the center position.

Step 4 Reset the WHITE BALance.

Viewfinder Adjustments

The Viewfinder is factory preset, but hallelujah, Sony has made the brightness and contrast viewfinder controls accessible for once without requiring a denuding of the camera. Both the CONTRAST and the BRIGHTNESS controls are located underneath the camera and are well marked. You will need a small screwdriver.

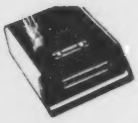
CAUTION: *LOOK BEFORE YOU TURN!* Be careful you don't turn the ELECTRICAL FOCUS screw by mistake.

Weird Problems—Camera Troubleshooting:

- Color Edge Drop Off—You will notice a color change near the lower left edge of the picture during camera monitoring or VTR playback in color. Adjust the ELECTRICAL FOCUS control.
- Image lag—Let the camera warm up for 15 to 30 minutes before shooting.
- Funky Color—You cannot seem to get the White Balance to produce the right colors. Check for the proper filter and reevaluate what is your *DOMINANT* light source. Make sure your color monitor is properly set for the correct HUE and CHROMA (Color). Calibrate it with a color bar tape, or tune your monitor/receiver to a local TV station and adjust your set for the correct color.
- Interference Lines in Color—Make sure the VTR is set in COLOR mode.
- Camera ON/OFF switch doesn't work or viewfinder indicator light doesn't function properly—Check for a broken wire in the 10-Pin plug or cable, a bad connection, a weak battery, or a faulty VTR.

Helpful Operating Hints

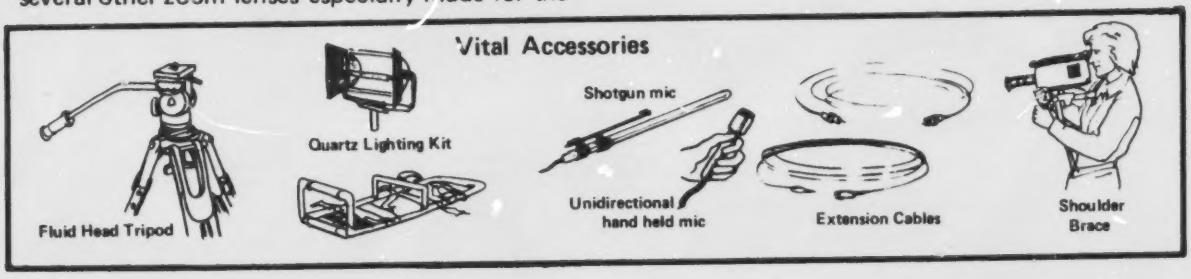
You really need a color monitor at all times to accurately check the color adjustment and lens openings of the camera unless you develop an ability to know what is the best lens opening for the various types of light. Ideally, you need to calibrate the monitor with a color bar tape first and then set your lens openings and the White Balance. The correct lens opening or aperture is crucial to obtaining the really vibrant colors that the DXC-1600 can produce. If you're one f. stop off, you can lose a lot of color and picture clarity.



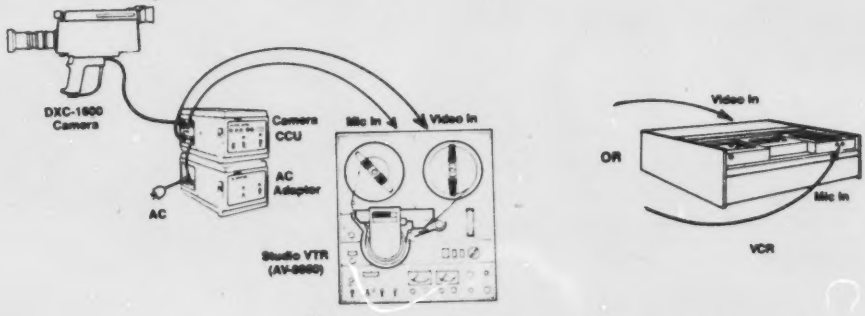
The angle of lighting is critical also. Outdoors, with the sun at your back, the camera will produce fine color—usually at f. 8, but the harsh shadows created by direct sunlight will become almost completely blacked out to the camera. This is a problem. Avoid harsh backlight like bright skys or bright lights. They will ruin your color and picture quality.

Indoors, you need lots of lights, because Sony really shortchanged the DXC-1600 camera with the slow 2.5 lens that comes with it. Granted, its a lightweight lens, but it robs the camera of considerable flexibility. If you can afford it, there are several other zoom lenses especially made for the DXC-1600 camera. Tamron who makes the 2.5 (6:1) zoom lens that comes with the camera, also makes a 14-140 mm (10 to 1) zoom lens which is also a MACRO lens that can focus down to a few feet. This lens is also much faster (f. 1.9) and it therefore allows the camera to work in half as much light as it would ordinarily need. The Tamron 10:1 lens costs about $800.

NOTE: Only special C-mount lenses designed especially for the Trinicon tube cameras can be used because of the particular design of the Trinicon tube assembly, otherwise vignetting will occur around the picture edges.

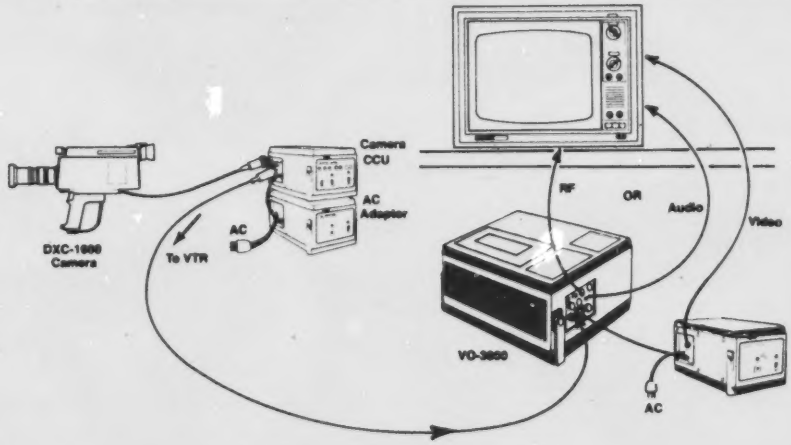


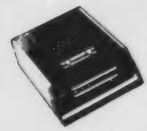
Operation of DXC-1600 with Studio VTR



Use the VIDEO OUT and MIC OUT plugs on the CCU and connect the CCU to the VIDEO IN and MIC IN Plugs on the VTR.

Monitoring of DXC-1600 and Playback of VO-3800 through TV Monitor in Color





Step 1 Use the large multi-pin cable to plug the AC Power Adaptor into the AV-3800 VCR.

Step 2 Plug the AC Adaptor into any 120 Volt AC source.

Step 3 Connect the VO-3800 to a TV monitor using either the VMC-1M 8-Pin to 10-Pin cable, the VIDEO and LINE OUTput plugs or the RF OUT plugs and cables.

Step 4 Plug the camera and the CCU into the VO-3800 if desired.

Step 5 Push the RECord button for camera monitoring (E to E) or FWD for VTR playback.

Recording Off-the-Air

Step 1 Connect the VMC-1M 8-Pin to 10-Pin cable to a monitor/receiver.

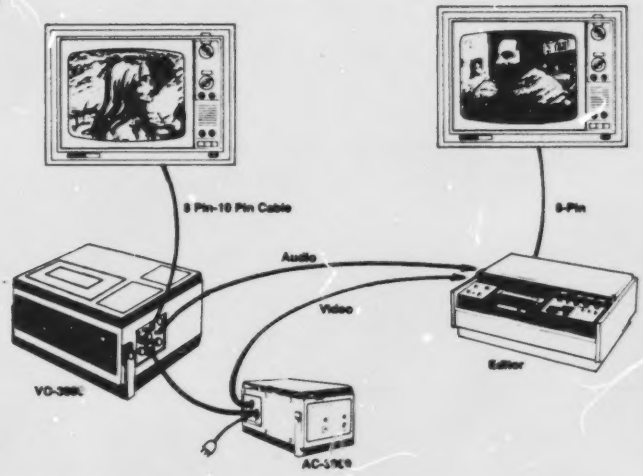
Step 2 Tune the monitor/receiver to the correct channel.

Step 3 Place the VTR in the RECord mode.

Step 4 Rewind the tape and connect the AC-3000 for color playback.

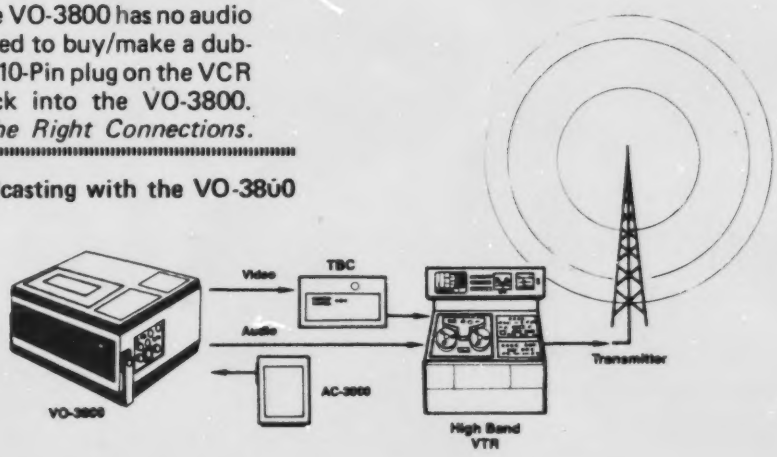
Step 5 Sit back, relax, and play back the tape.

Editing with the VO-3800



NOTE: Unfortunately, the VO-3800 has no audio LINE IN plugs, so you need to buy/make a dubbing cable or tap into the 10-Pin plug on the VCR if you want to dub back into the VO-3800. *See Chapter 7—Making the Right Connections.*

Direct Over-the-Air Broadcasting with the VO-3800



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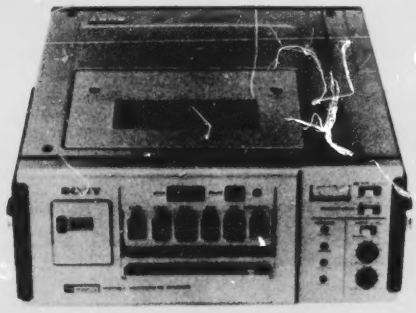
VO-4800 Portable VCR

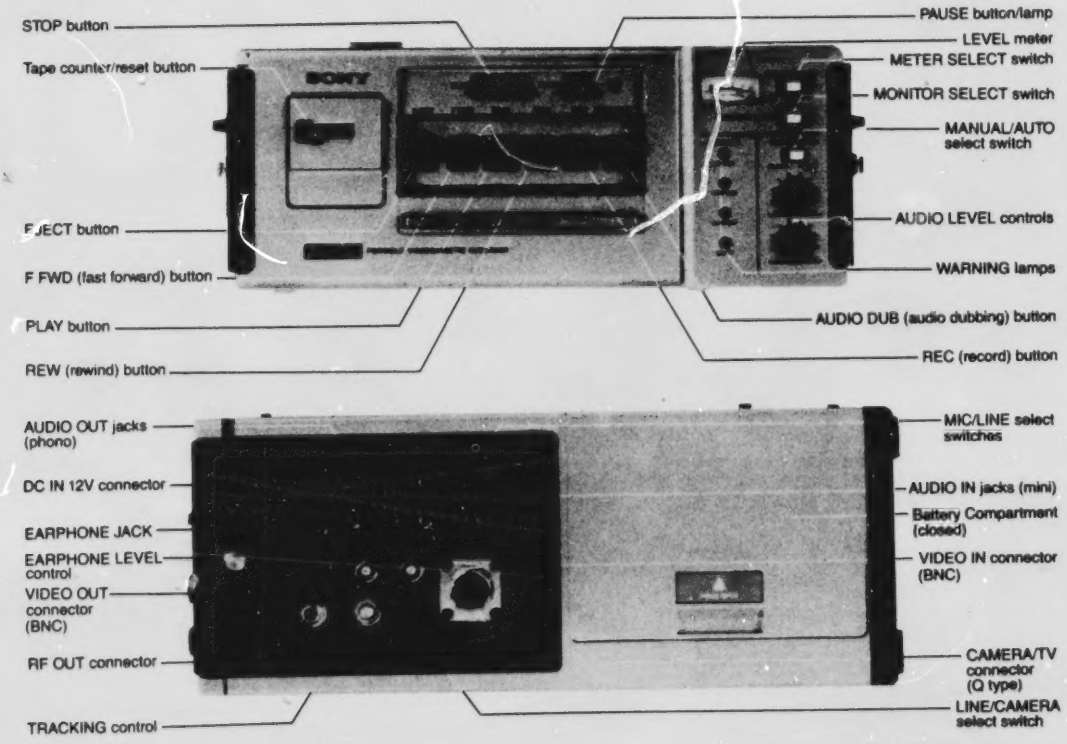
Although the VO-3800 was a technological breakthrough at the time of its introduction and enjoyed great popularity for a short while, the JVC CR-4400 portable VCR soon stole the show. Sony, though, has taken the lead again with the remarkable VO-4800.

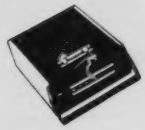
Besides improved picture quality of 45 db and 260 lines color resolution and an audio frequency response of 50 Hz to 12 kHz, the unit also has built in precise back-space editing, built-in color recording and playback ability, a recording time of 2½ hours on a single battery charge (BP-60) and 50 minutes operation with the Sony DXC-1610 or DXC-1640 cameras, a noise-free freeze frame, switchable manual AGC audio controls, audio VU meter and built-in RF modulator.



VO-4800

Unique features found only on the VO-4800 are fast picture search mode where the picture is visible in both Fast Forward and Rewind modes, two-camera recording capability by switching the LINE/CAMERA selector and a safeguard warning system which incorporates visible LED and audible beep tone signals to warn the operator of low battery power, moisture condensation, tape slack, incorrect servo-lock or end of tape. The warning signals also appear in the viewfinder of the DXC-1640 camera. At 22 lbs. fully loaded, the VO-4800 is the most lightweight portable ¾-inch VCR available. Price is $3,300.





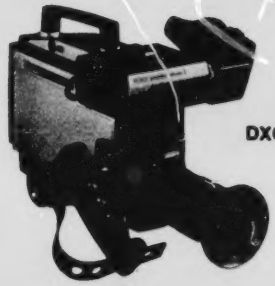
THE SONY DXC-1610/DXC-1640 PORTABLE COLOR CAMERAS

DXC-1610

Although the DXC-1600 color camera was a pretty good first try by Sony to produce a low cost, quality portable video camera, it suffered from several serious design deficiencies. The camera was too heavy to hold by hand for any length of time without a shoulder brace; the separate CCU was too bulky and a serious handicap to system portability; and the camera's low-light ability was very poor. The picture often had a "lag" problem, and eventually the lower left edges of the image would develop a green tint.

The second generation DXC-1610 was certainly a major improvement over the physical design of the earlier DXC-1600 camera, but the overall color performance was only slightly improved. The DXC-1610 still suffered from the characteristic image lag and needed a large amount of light (50-100 footcandles) to produce a good picture. The lens was a slide zoom type which made slow zooming nearly impossible. There are many less expensive cameras that can take equal or better pictures in much lower light with less lag such as the JVC G-71, Panasonic WV-3800 or WV-3320, Hitachi GP-7 and others. Some of the other cameras also have automatic iris and automatic light control systems and weigh much less. However, these other cameras are newer technology and many are not as well built and as well designed physically as the Sony.

The DXC-1610 is a completely self-contained, CCU-less portable color video camera. It can be powered 4 ways—from a portable VCR, from a car battery, off AC power or with a clamp-on optional BP-60 battery pack. Because the camera has an extremely low power consumption (only 11 watts), it will operate for 3 hours with the BP-60 battery or 45 minutes with a portable VCR as a power source. With the battery pack, the camera weighs only 15 lbs. The camera also has a useful rotatable, tiltable viewfinder, which with the shoulder mount design, makes hand-held shooting more practical.



DXC-1640

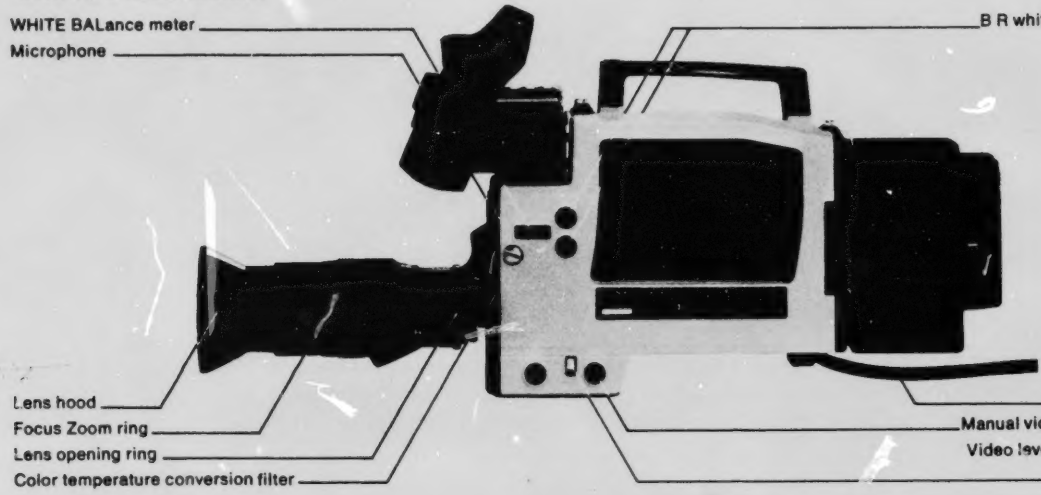
The newer DXC-1640 ($3,450) retains the same self-contained physical design of the DXC-1610, but adds several new internal and external features. The 1-inch Trinicon tube has been replaced with a smaller more efficient 2/3-inch Trinicon tube for improved reduction of image lag, better sharpness (300 lines, 45 db) and better low-light capability (10 foot candles). The lens is a new 6 to 1 macro zoom with a fast F 1.4 maximum aperture. A 3-way lens iris control (AUTO, MANUAL and AUTO LOCK) assures correct light exposure, and the AUTO LOCK mode is designed to maintain proper exposure under rapidly changing lighting conditions. A power zoom lens is also an option.

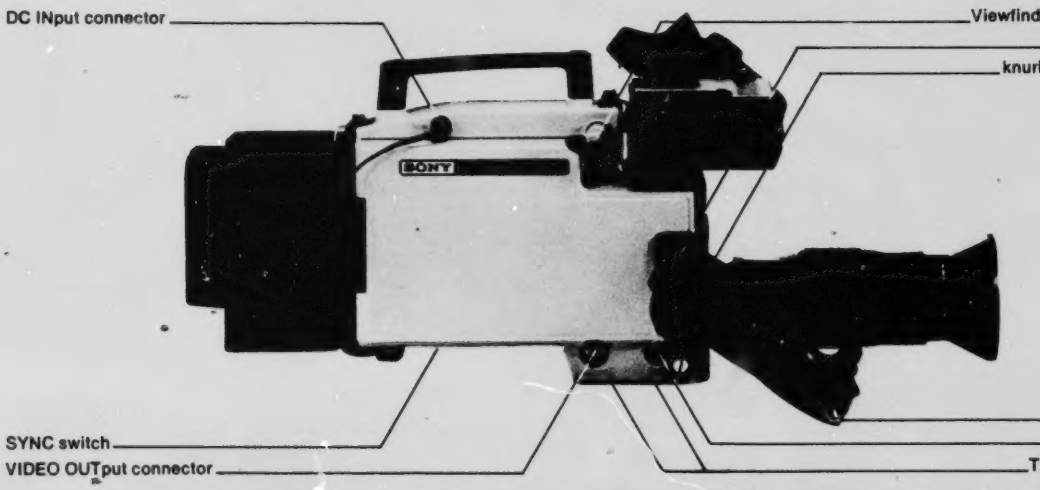
Internal controls are provided for adjustment of horizontal and vertical blanking widths which helps avoid problems in editing. A new 14-Pin camera cable plug permits greater monitoring capability when used with the Sony VO-4800 VCR but is not compatible with the standard 10-Pin plugs in common use on other portable VCRs. The weight of the camera has been reduced to less than 10 lbs. including lens, and the power consumption is 11 watts.

Additional Features include:

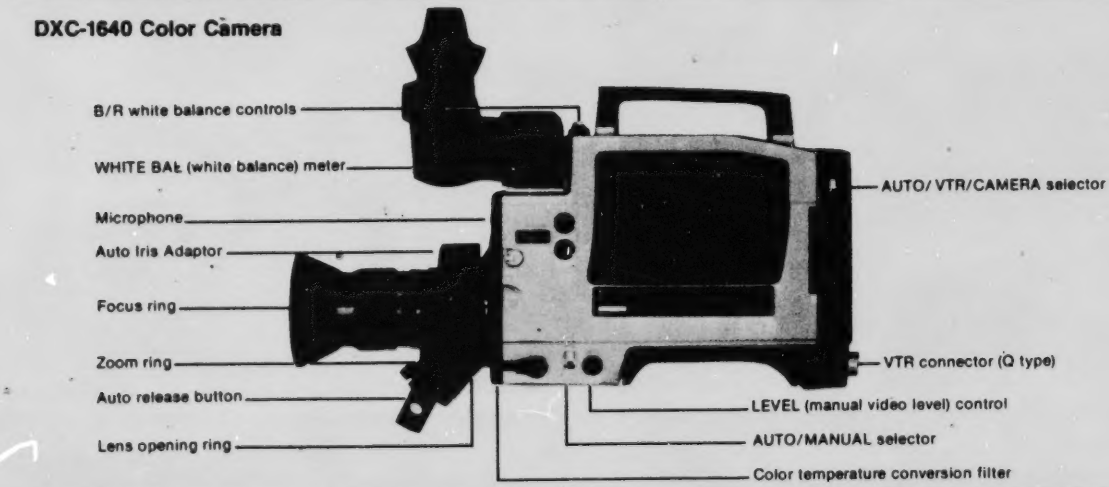
- VTR playback in viewfinder
- External BRIGHTNESS and CONTRAST controls on viewfinder
- Built-in electret condenser microphone
- An external microphone can be plugged into the camera
- Built-in color temperature filter
- White Balance control is on the camera with a meter
- AUTO/MANUAL video level control
- Remote VCR start/stop control
- External sync facility

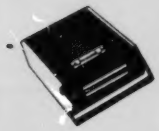
DXC-1610 Color Camera





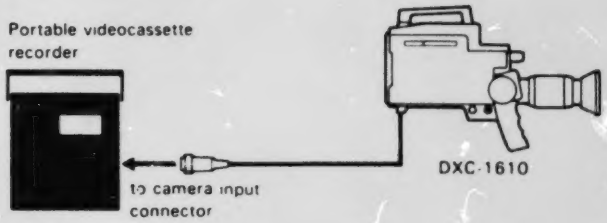
DXC-1640 Color Camera



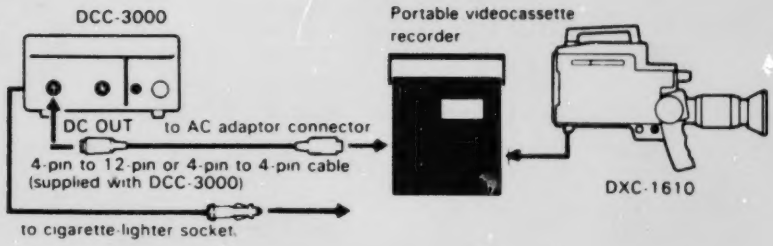


4-Way power source

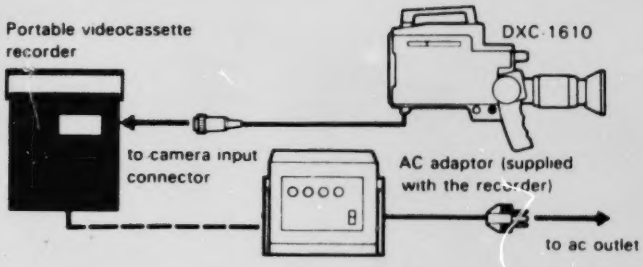
Portable videocassette recorder
A fully-charged battery inside the recorder allows up to 45 minutes of continuous operation.

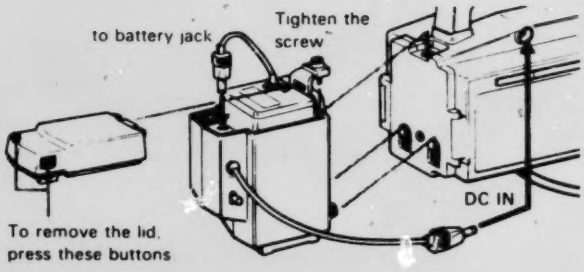


Car battery adaptor
The optional DCC-3000 car battery adaptor allows the DXC-1610 to be operated through videocassette recorder from a car battery power source.



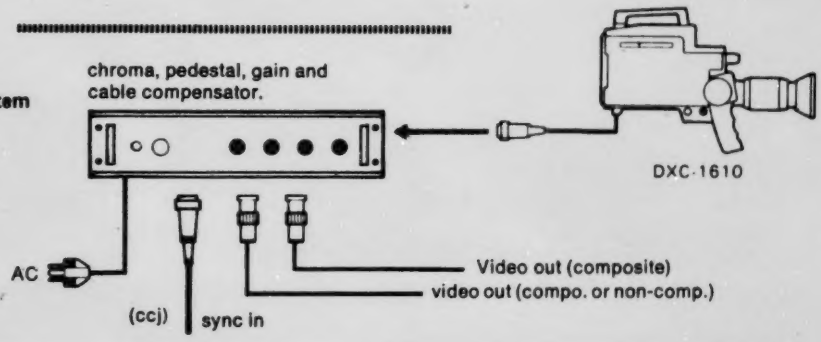
AC adaptor
The optional CMA-5 camera adaptor allows operation of the DXC-1610 from any wall outlet supplying 120V AC, 60 Hz.

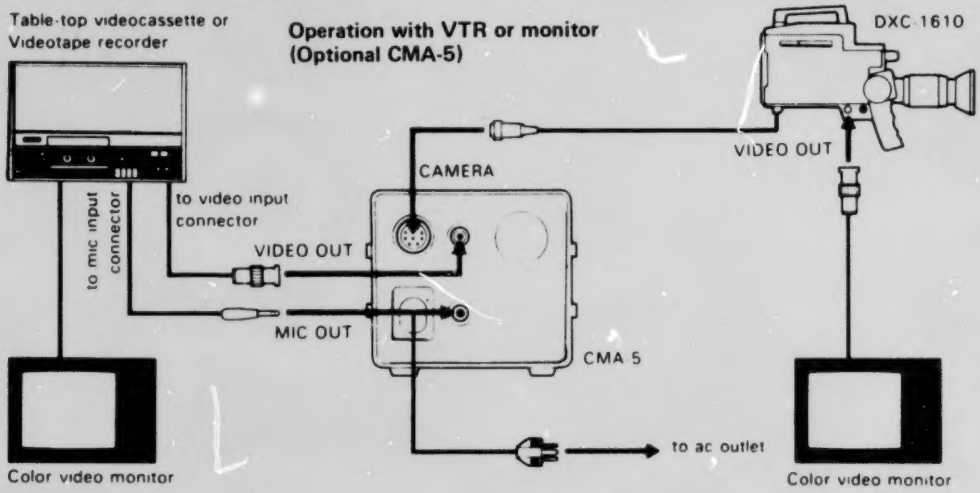




Battery pack
DC-5 battery adaptor is supplied: BP-60 battery pack is an optional accessory. With BP-60, the DXC-1610 operates up to 3 continuous hours.

Operation with external sync system (Optional CMA-6)



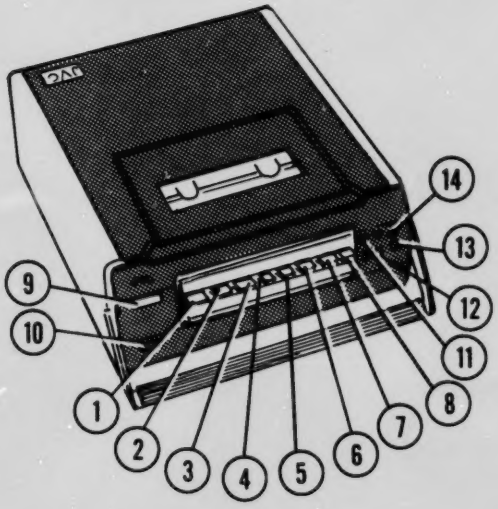


JVC CR-4400U Portable Videocassette Recorder:

About a year after Sony introduced the VO-3800 VCR, JVC marketed their version of a ¾-inch U-Matic portable VCR—the CR-4400U. Less expensive ($2,700) than the VO-3800 ($3,000) the JVC incorporates a series of advanced and useful features:

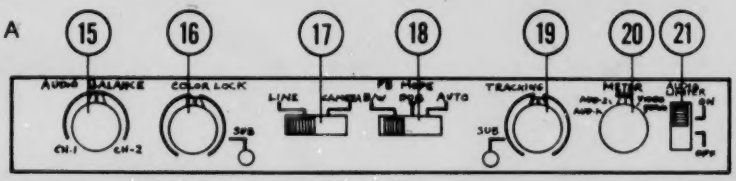
- Capstan Servo—This greatly increases the mechanical and electronic stability of the VCR and allows VCR to lock up to external sync during playback. This results in improved time base stability.
- Compatible with all U-Matic VCRs, it uses compact 20-minute KCS cassettes which will fit all U-Matic VCRs, regardless of size.
- Color Playback in the field—Built-in color recording and playback circuitry. The CR-4400U *DOES NOT* need a color adaptor to playback in color.
- AEF (Automatic Editing Function)—The VCR automatically back spaces every time the tape is stopped by the camera and performs a clean assemble edit when the tape is restarted again.
- Pause/Still function
- Multi-Purpose checking meter with 5 functions
- Built-in dropout compensator
- Weight—25 lbs.
- Special tape dubbing mode to insure high quality stability and picture quality.
- Improved signal-to-noise ratio—45 db, comparable to Sony Type II VCRs.
- Low power consumption—13.5 watts. Will run for 2 hours on internal battery.
- 3-way power supply-AC, battery pack, and car battery
- Optional RF Adaptor
- Improved audio circuitry—Audio balance control, built-in limiter and manual control and meter for checking recording levels. Sound can be monitored in stereo.
- VIDEO IN/VIDEO OUT/LINE IN/LINE OUT plugs built-in on VCR.
- Small compact AC Adaptor and battery charger.
- Records in stereo—2 track audio

CR-4400U VCR



Mechanical Controls–CR-4400U

1. *EJECT*–Push to release
2. FAST FORWARD (*FF*)
3. *STOP*–Stops the tape.
4. *PLAY/REC*ORD
5. *REW*IND
6. *REC*ORD
7. *AUDIO DUB*–Push to add new sound to a prerecorded tape.
8. *PAUSE/STILL*–Stops the recorder during the RECORD or PLAYBACK mode and displays a still picture in the PLAYBACK mode.
9. TAPE *COUNTER*–Records the amount of tape used.
10. MULTI-PURPOSE METER–Indicates battery power, CH-1 or CH-2 audio levels, video level and servo lock condition with turn of the switch.
11. *EAR*PHONE MONITORING JACKS–Use to monitor sound levels.
12. *MIC*ROPHONE JACKS–600 ohm, -70 db
13. *REMOTE* CONTROL JACK–Use the optional RM-41U remote control to start, stop, play or record remotely with the VCR.
14. *WARNING* LAMP–Warns of low battery power or moisture condensation. Moisture condensation could cause the tape to seize up around the video head drum.



Electronic Controls A

Unlock the front panel

15. *AUDIO BALANCE* CONTROL–Selects either audio channel or adjusts the relative sound levels of the channels.
16. *COLOR LOCK* CONTROL–Adjust control if the colors shift.
17. *LINE/CAMERA* SWITCH–Selects the correct input source. Use the CAMERA input for JVC cameras and the LINE input for non-JVC cameras.
18. *PB* (PLAYBACK) *MODE* SWITCH–The DUB mode improves the color picture quality when copying tapes by shutting off the automatic phase control circuitry.
19. *TRACKING* CONTROL–Adjust if there is any distortion in the picture during playback.
20. *METER* SWITCH–Changes the meter function.
21. *ON/OFF AUDIO LIMITER* CONTROL–In the ON mode, sounds that are too loud are automatically compressed to normal levels. Use OFF for manual control of audio levels.

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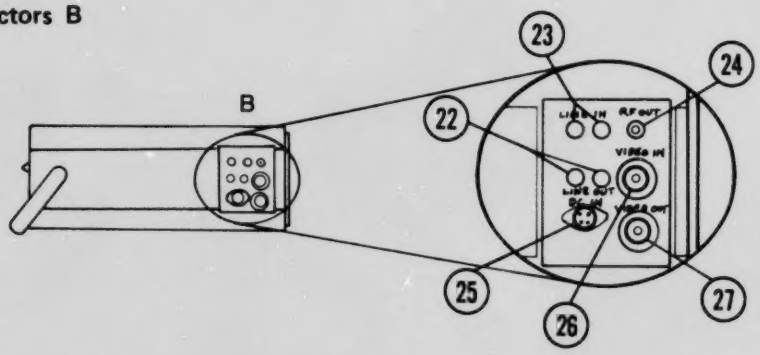
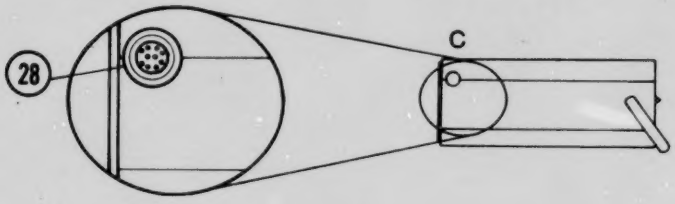
Plugs and Connectors B

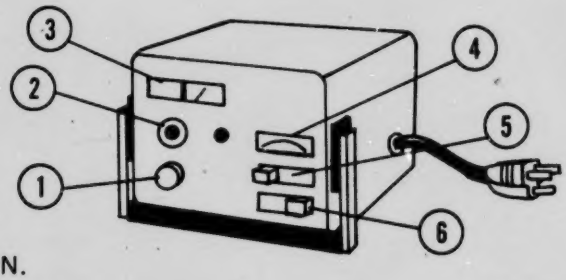
Side Panel



22. AUDIO *LINE OUT* PLUGS—CH-1 and CH-2—Connect to editing VCR, TV monitor or stereo amplifier.
23. AUDIO *LINE IN* PLUGS—CH-1 and CH-2—Connect to the output of a sound mixer, audio-cassette recorder or playback VTR.
24. *RF OUT* PLUG—Connect to the VHF terminals of any TV set for playback (must have optional RF Adaptor KR-234U or KU256U).
25. *DC IN*PUT PLUG—Connect to the external 3-hour long life battery (4-Pin), a car battery adaptor, or AC Adaptor.
26. *VIDEO IN* PLUG—Connect to non-JVC NTSC color cameras, CCUs or video output of a playback VTR or TV monitor.
27. *VIDEO OUT* PLUG—Connect to monitor or editing VCR. Use VC-224U 8-Pin monitor cable (optional).
28. CAMERA CONNECTOR—C—JVC 10-Pin connector will work with all JVC 10-Pin connector cameras and Hitachi and Panasonic cameras wired to the JVC type 10-Pin connector.

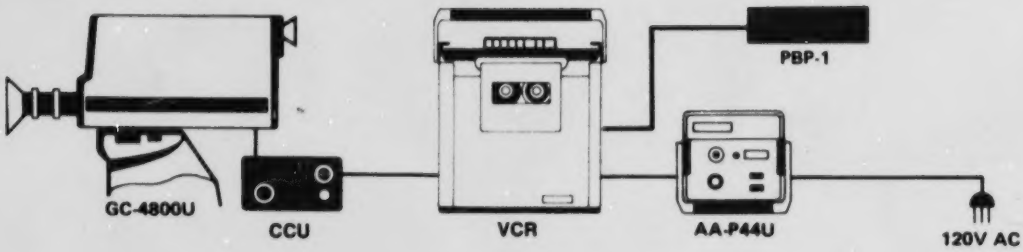


AA-P44U AC Power Adaptor/Battery Charger



1. *POWER* SWITCH
2. INDICATOR LAMP—Indicates the unit is ON.
3. *FULL CHARGE* INDICATOR—Indicates full battery charge.
4. *CHARGING* METER—Indicates the progress of the charging cycle.
5. *METER SELECT*—Selects meter read function.
6. MODE SWITCH—Use CHARGING to charge the battery and VCR for AC operation of the VCR.

GC-4800U
Camera Set Up and Recording Procedures



Step 1 Connect the camera to the CCU and the CCU to the VCR.

Step 2 Make sure the battery pack (PBP-1) is inside the VCR and charged. For AC operation, make sure the AC charger is connected to the VCR.

Step 3 Load the tape in the VCR.

Step 4 Turn on the AC Adaptor power switch and/or push the RECord button on the VCR. The indicator lamp will light.

Step 5 Select the proper COLOR TEMPERATURE setting on the CCU:

☼	**OUTDOOR**—Set for recording in daylight (midday).
☼	**MORNING EVENING** Set for morning and evening light
☼	**INDOOR**— Set for Quartz, Tungsten or Incandescent light.

Step 6 Adjust the lens aperture—Point the camera at the subject and open or close the lens iris until the white line in the viewfinder is centered.

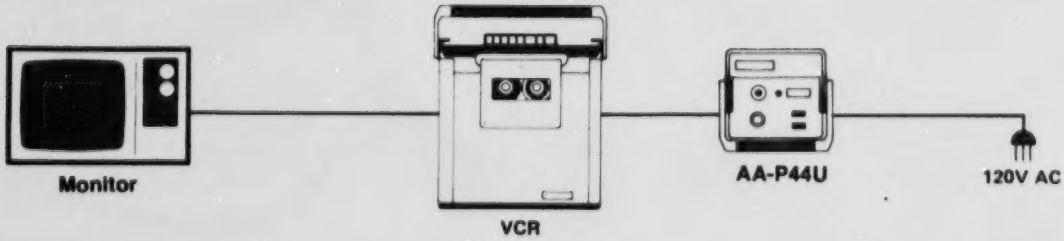
Step 7 Press the camera trigger and begin recording. Be sure to monitor the sound.

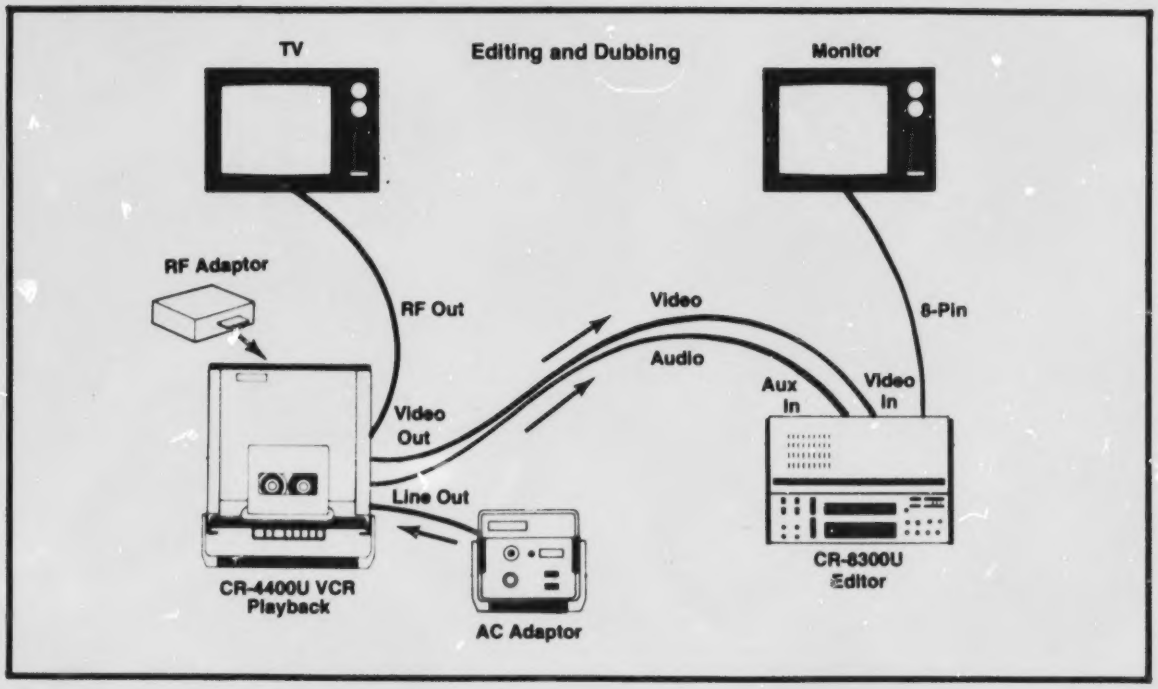
Step 8 Record some Academy Award-Winning Footage.

Picture Playback through the Camera Viewfinder

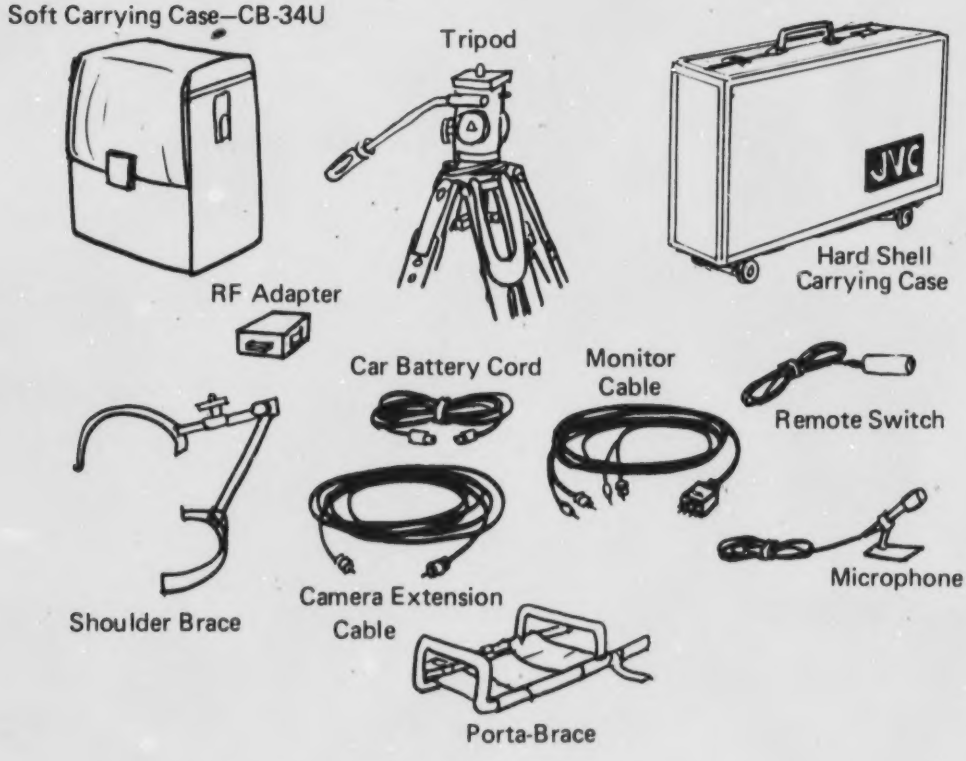
Rewind the tape and play the tape back. The picture will appear in the camera viewfinder and the sound can be monitored through the earphone output plugs on the VCR.

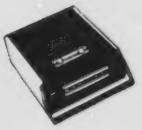
VCR Playback in Color on a TV Monitor





Vital Accessories

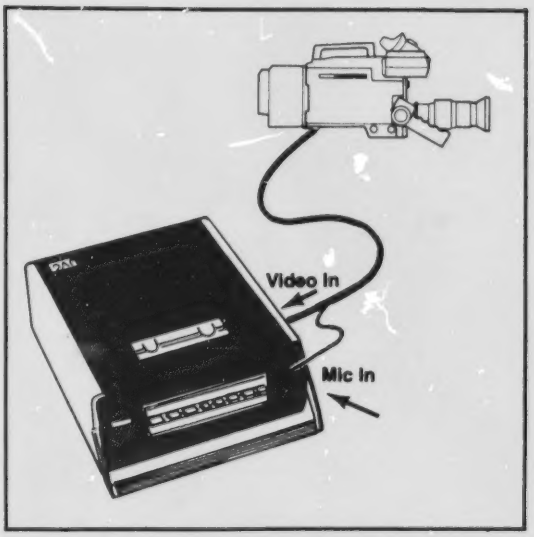




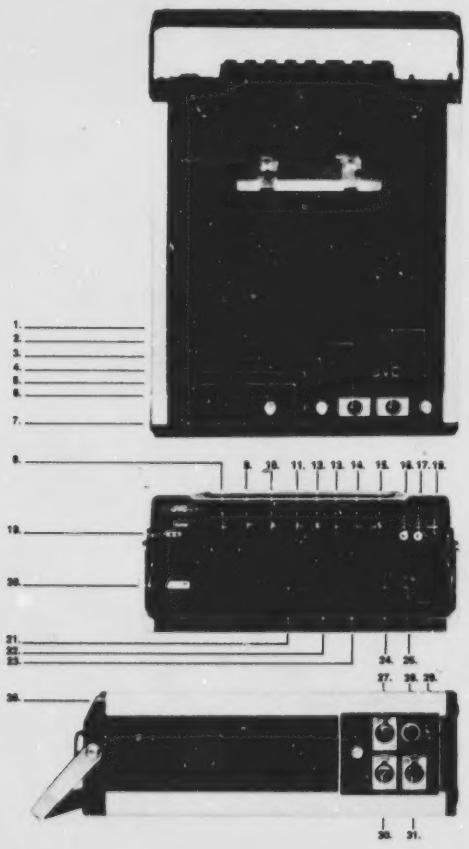
Use Of Non-JVC Cameras with CR-4400U VCR

Even though nearly all portable VCRs use a standard 10-Pin connector, the pins are often wired differently, depending on the manufacturer. Sony wires their 10-Pin cables and connectors one way, and JVC, Panasonic, and Hitachi wire their 10-Pins another way. The pins can be rewired for a particular camera type, a 10-Pin conversion cable made, or you can use the VIDEO IN plug on the side of the VCR for video and the MIC 1 or MIC 2 plugs for audio. If you use the VIDEO IN plug, the camera's output must be COMPOSITE SYNC, NTSC COLOR. Make sure the LINE/CAM switch is in the LINE position.

NOTE: The 10-Pin connector on the VCR provides remote start/stop of the VCR from the camera, return video and power to the camera, as well as video and audio inputs.



JVC CR-4400LU



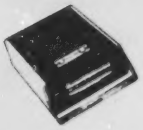
CONTROLS

1. Video Output Connector (BNC)
2. Audio Output Connectors (XLR)
3. SC* Input Connector (BNC)
4. SC Internal/External Switch
5. Sync Internal/External Switch
6. Sync Input Connector (BNC)
7. Audio Input Level Controls and Limiter Switch
8. Eject Key
9. Fast Forward Key
10. Stop Key
11. Play-Record Key
12. Rewind Key
13. Record Key
14. Audio Dubbing Key
15. Pause/Still Key
16. Earphone 1 Jack (Mini Plug)
17. Earphone 2 Jack (Mini Plug)
18. Battery Warning Indicator
19. Tape Index Counter
20. Multi-Purpose Meter
21. Color Lock Control
22. Line/Camera Switch
23. Playback Mode Switch
24. Tracking Control
25. Meter Function Switch
26. Video Input Connector (BNC)
27. Mic/Line Switches
28. Camera Input Connector
29. Remote Control Connector (SPECIAL)
30. Audio Input Connectors (XLR)
31. DC Power Input Connector (XLR, 4 Pin,

*Sub-carrier

JVC, like Sony, also makes a broadcast version of their ¾-inch VCR. Basically an upgraded CR-4400U, the CR-4400LU includes a convenient top panel with broadcast standard audio and video connectors. BNC plugs are used for video and XLR (cannon) plugs for audio. The levels of the audio and video input and output signals are also broadcast standard, and external vertical sync and subcarrier inputs and switches are provided so the VCR can be used with a time base corrector.

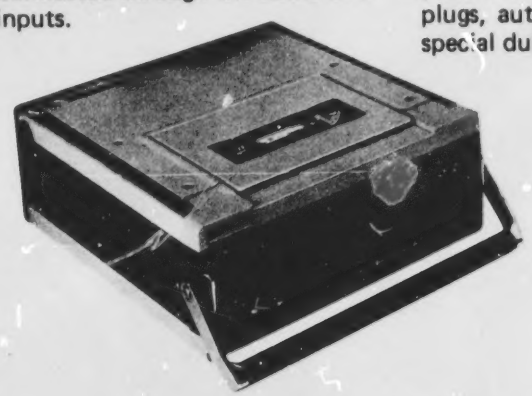
The CR-4400U has earned the respect of many critical broadcast and industrial users as a versatile, compact and well designed quality VCR having more useful features than the Sony VO-3800. The CR-4400LU now offers even greater flexibility to the broadcast oriented user.



Hitachi SV-340

Hitachi markets its own version of the very popular CR-4400U, and calls it the SV-340. Essentially the same recorder with a different name, it will directly interface with all Hitachi cameras through the 10-Pin connector. Other cameras can be connected through the audio and video auxillary inputs.

Many users prefer the CR-4400U to the Sony VO-3800 because of the CR-4400U's higher signal-to-noise ratio (45db vs. 40db), its self-contained design (no auxillary box needed), built-in audio limiter and balance controls, complete set of video and audio inputs and output plugs, automatic backspacing editing mode and special dubbing mode.



Hitachi SV-340

The Panasonic WV-3700/NV-9400 Portable Color Recording System

This system is designed so that the camera CCU will fit together in tandem with the recorder. A ¾-inch videocassette system designed primarily for broadcast applications, the unit incorporates built-in color circuitry and requires no external color adaptor for color playback like the Sony VCRs (VO-3800 and BVU-100).

System features:

- ·3-way power operation
- ·Compact recorder—weighs 25 lbs.
- ·Automatic Assembly Editing (AAE) from STOP mode
- ·60 minutes of operation with a fully charged battery
- ·Capstan-servo with crystal sync for improved stability
- ·HPF tm video heads
- ·Automatic Phase Control (APC)
- ·Special dubbing mode—turns APC off
- ·5-function meter

Panasonic WV-3700EN/NV-9400 Portable System

Industrial and Broadcast Portable Cameras

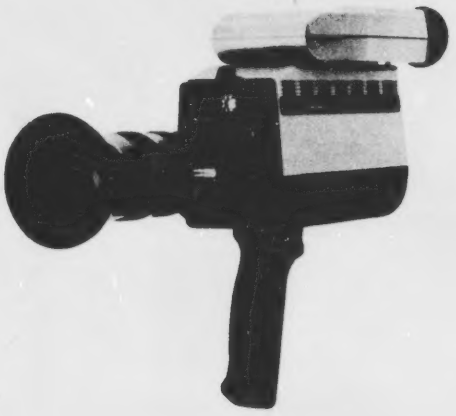
The low-cost ($1,300-$5,000) industrial cameras generally use a single 1-inch color vidicon tube and have simple electronic systems. The $5,000 to $20,000 range cameras use 2 or 3 tubes and the $20,000 and up broadcast cameras use 3 Plumbicon or Saticon tubes. Most TV news crews use very sophisticated portable cameras which feature excellent light sensitivity and extremely high quality color. Performance is somewhat related to price, but because of rapidly advancing camera technology, one should test out a prospective camera personally and thoroughly, and compare it with other models.

PORTABLE COLOR CAMERAS

JVC G-71US

- Uses conventional or rechargeable batteries, AC power or VCR power
- 10-Pin and camera cable plug kit allows connection to any VCR
- Ingenious LED light exposure indication system
- 1 1-inch striped vidicon tube
- C-mount 6:1 auto-iris zoom lens
- Low power consumption—12 watts
- Lightweight—8.1 lbs.
- Minimum light—9 footcandles
- Completely self-contained
- An excellent, incredibly good and well-designed camera for the price—only $1,400

Hitachi GP-5



- 1-inch Tri-electrode tube
- Single knob color correction control
- Very lightweight—4.8 lbs.
- Good light sensitivity
- Low price—$1,400
- Built-in condenser microphone
- 1.5-inch electronic viewfinder with built-in audio monitor and volume control.

Panasonic WV-3300

- Vertical and horizontal aperture correction circuits
- 4-position color temperature switch and white level set
- Minimum illumination is 15 foot-candles at f 2.0
- 1-inch color vidicon tube
- Standard C-mount lenses
- Weight only 5.6 lbs.
- Requires external CCU (2 lbs.)
- Manual adjustment of R and B levels
- 6:1 zoom and optional wide-angle lens
- Low-cost—under $1,400
- 45db picture at 140 footcandles
- Designed for easy connection with NV-8400 portable VHS VCR
- A very lightweight, intelligently designed camera that produces good pictures in low light. An optical viewfinder and fixed-focus lens version is also available.

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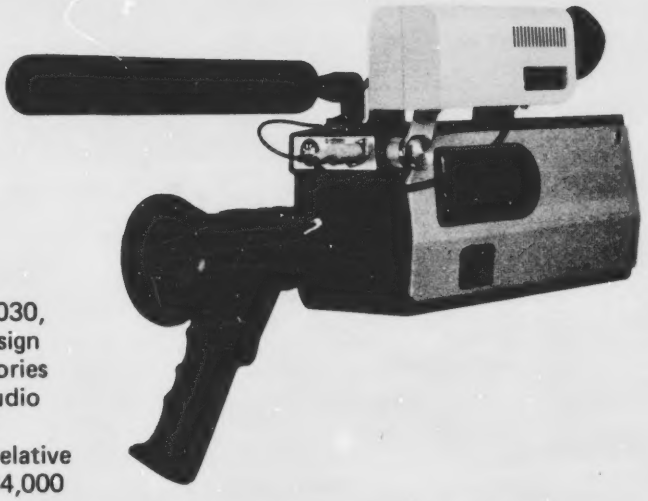
JVC GC-4400

- 2 2/3-inch Saticon tubes
- 400 lines resolution
- 45db signal-to-noise ratio
- Low light level switch
- Sensitive to 9 fc
- Auto-iris/manual control
- Built-in tally light
- Special lens mount
- Rotable viewfinder
- White Balance control
- 6:1 zoom lens
- Price: $2,700

Hitachi GP-7 (replaces FP-3030)



- Optional genlock
- Standby/operate switch
- Rugged die-cast housing
- Compact and lightweight—11.4 lbs.
- Low power consumption—11 watts
- 1-inch Tri-electrode tube
- Provision for optional intercom
- White balance indicator in viewfinder
- The successor to the very popular FP-3030, the GP-7 is an intelligent modular design which accepts a wide range of accessories and will operate in ENG/EFP and studio applications. It is well built, and has improved color and light sensitivity relative to the FP-3030 and is priced under $4,000

Panasonic WV-3800

- Built-in color bars, color temperature compensation and neutral density filter wheel
- Modular design—can add 5-inch viewfinder
- 1-inch stripe filter vidicon tube
- Completely self-contained
- Auto-iris 6:1 zoom lens
- +6db gain switch
- Built-in genlock
- Priced about $3,500
- Rugged shoulder-mount design
- Optional remote control unit for multi-camera applications

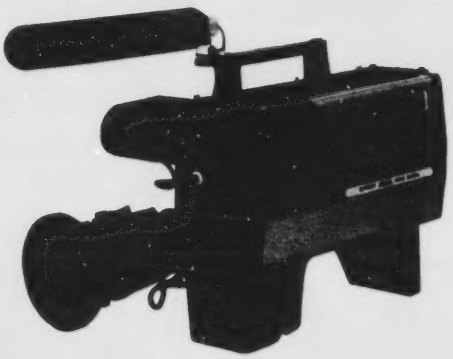
Sharp XC-320U

- Weight—12.1 lbs.
- 3 Vidicon tubes
- AC or DC power
- Unified mounded housing block contains lens, beam splitter, coil assembly and tubes which eliminates mechanical registration problems
- C-mount lens, 6:1 zoom, f 1.8
- VTR start/stop switch
- Minimum light—15 footcandles with +6db gain switch on
- Built-in light level indicator
- Price under $5,000

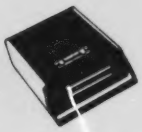
Hitachi FP-20S

- 3 2/3-inch Saticon tubes
- Genlock optional
- Registration check system
- Optional contour enhancement
- Color bar generator
- Dichroic mirror optics
- 49db, 500 lines resolution
- Weight—12 lbs. without lens
- S-mount lens
- 7-inch studio viewfinder optional
- Sensitivity—15 fc at +6db gain
- +12V DC, 20 watts
- Price is $17,500

Hitachi FP-40S



- 3 2/3-inch Saticon tubes
- Prism optics with bias light
- Quick release bayonet lens mount
- +12V DC, 19 watts
- +6db and +12db gain control
- RGB signal outputs
- Built-in color bar generator and microphone amplifier
- Optional 5-inch studio viewfinder
- Optional genlock
- 50db, 550 lines resolution
- 13.2 lbs. without lens
- Price is $28,500



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JVC-KY-2000U

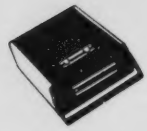
- 3 2/3-inch Saticon tubes
- Operates on standard 12 volt power supply
- Includes 10:1 C-mount power zoom
- Built-in genlock
- 23 fc light sensitivity
- Studio/ENG packaging
- 52 db, 500 lines resolution
- Memory White Balance
- Weight--only 15.2 lbs. with lens and viewfinder
- +6db and 12db gain switch
- Battery or AC adaptor attaches to camera
- Price is $9,500 complete
- An incredible camera for the price!

Panasonic AK-750

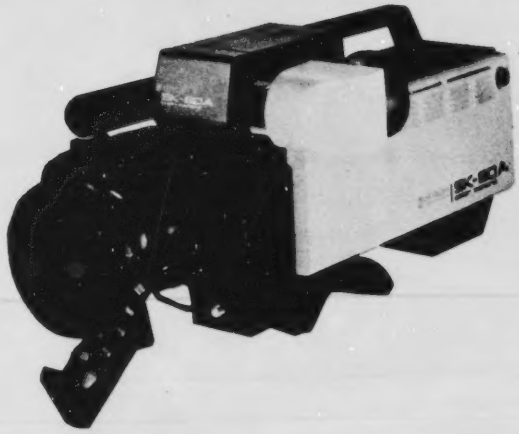
- 3-tube design—can take 2/3-inch Plumbicon, Newvicon, or Vidicon tubes
- Optional b&w balance analog memory
- Automatic white balance
- Built-in bias light
- High-gain switch
- Modular system
- Price of $18,000
- 4-position filter wheel
- Electronic color temperature conversion
- Camera function indicators in viewfinder
- Built-in color bars and aperture correction circuit

Philips LDK 14/Ampex BCC-14

- 1½-inch and 5-inch viewfinders
- Built-in genlock
- Optional remote control
- 5-position filter wheel
- Rugged one-piece construction
- 3 2/3-inch Plumbicon tubes
- +6db and +12db gain switch
- Operates in a variety of EFP and ENG modes
- Multiple function viewfinder indicators
- Weight—15.3 lbs.
- Price—$37,000

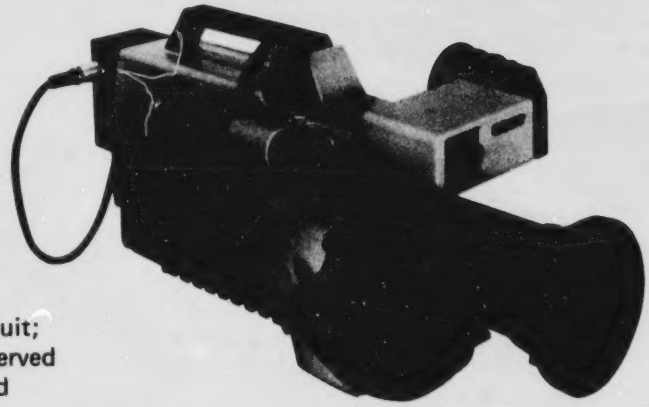


Hitachi SK-80A



- Automatic Beam Optimizer (ABO) (minimizes comet-tail phenomena)
- 3 Saticon tubes
- C-mount and ARRI mount lens capable
- Built-in contour enhancer and comb filter
- 17.4 lbs. without lens
- Color bar generator
- Automatic lens iris control
- Power consumption is 35 watts
- Price is $33,500

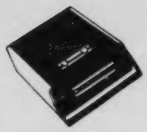
Sony BVP-300



- Weight—12.4 lbs. excluding lens
- Waterproof housing
- Price—$37,000
- Available with 3 Plumbicon or Saticon tubes
- Power consumption—19.8 watts (2 hours with BP-90 battery)
- 3-position gain switch, 0db, +9db or +18db
- Minimum illumination—2 footcandles with f 1.4 lens at +18db
- Automatic beam optimizer, lens iris circuit; white balance and black balance preserved in memory when power is interrupted
- Built-in 2-line image enhancement, masking circuitry and genlock
- Viewfinder indicators show video level, iris position, white and black balance, low battery voltage and VTR interface

Asaca ACC-2000

- 1 or 2 piece operation
- C, bayonet or Arriflex lens mounts
- 30-watt power consumption—2 hours on 7.2 volt NiCad battery
- Built-in genlock, video level indicator, color bar generator and test signal generator
- 2-line contour enhancement
- Remote control capability
- +9db gain switch
- 3 Plumbicon or Saticon tubes
- Price—$30,000
- Weight—22 lbs. without lens



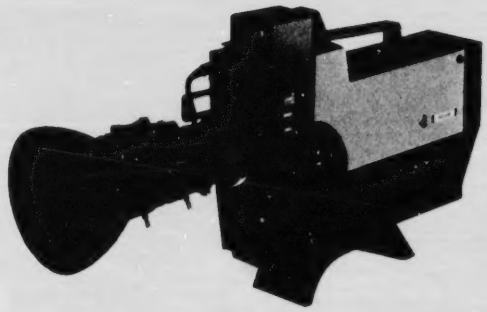
217

RCA TK-76/TK-76B

Camera Features:

- ·Shock mounted optical system
- ·Uses standard 16 mm lenses
- ·Low light level gain switch
- ·Automatic White Balance
- ·Built-in image enhancer
- ·Automatic iris control
- ·Built-in filter wheel
- ·Cost—$38,000
- · Can be used in studio configuration
- ·Operates off any 12 volt DC source
- ·Adjustable, rotatable viewfinder
- ·Built-in genlock and sync generator
- · Available on NTSC, PAL-B, PAL-M and SECAM standards
- ·LED (light emitting diode) indicators in viewfinder. Indicates: tally, camera battery, VTR battery, tape run out, tape motion and video level
- ·Weight—camera, viewfinder, lens and shoulder brace—20 lbs, battery pack—6 lbs
- ·Operates under extreme conditions—4°F to 122°F
- · This camera has been used world wide by TV station crews who are very demanding and require high performance under adverse conditions

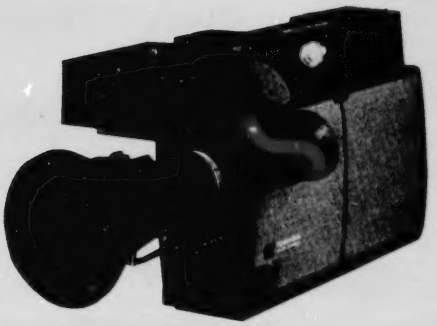
Ikegami ITC-350

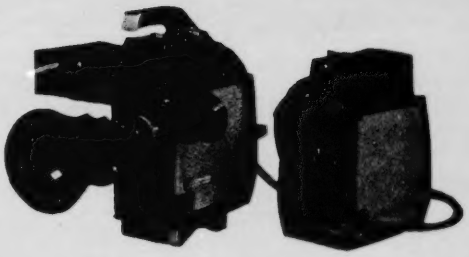


- · 3 2/3-inch Saticon tubes
- · Weight—11 lbs. body only
- · Low power consumption—15 watts
- · +6db and +12db gain switch
- · Studio and ENG configuration
- · Standby switch saves power
- · Prism beam splitter
- · 52db, 500 lines resolution
- · Bias light optical system
- · Viewfinder indicates battery level, tally, White Balance, VTR ON and video level
- · Auto-iris and Automatic Beam Control
- · Lens automatically closes when camera is turned off
- · Price is $17,000+

Toshiba PK-39

- Uses 3 Saticons or Plumbicons
- Two-piece construction
- 12V DC
- Built-in color bars, contour enhancement and signal processing
- Optional studio viewfinder
- Memory White Balance
- Viewfinder controls brightness, contrast and video peaking
- LED viewfinder warning lamps
- Automatic Beam Optimization (ABO)
- Built-in genlock
- 500 lines resolution
- Excellent low-light sensitivity
- Price is $40,000+





Video On Location—Excitement and Realism

There's nothing like the action, color and interest created by imaginative electronic field production tapes. With recent refinements and substantial reductions in costs of portable color cameras, it's now possible to achieve good production results with a minimum of equipment and knowledge.

This is not to say that one shouldn't learn as much as possible about lighting, audio, camera technique, organization, scripting, directing, acting, etc. Unfortunately, many video users suffer from the misconception that good video means any kind of an image on a TV screen. It's especially easy just to shoot and shoot outdoors with little attention paid to the skills of preliminary planning and the myriad of details required for a successful production.

But, experience is the best teacher, and the accumulation of production experience will lead to a refined knowledge of the art. So, get in there and do it, and don't let equipment breakdowns, forgotten audio cables, insufficient tape, blown fuses and wrong microphones discourage you. With practice, things will soon come together smoothly.

Shooting on location or Electronic Field Production (EFP), as it is often called, can produce an effective and successful tape. Shooting in natural environments definitely adds authenticity and credibility, since the artificiality of the studio is eliminated, and the lighting and color is often much more pleasing.

However, outside you are faced with the totally unpredictable nature of the outdoor environment. Whereas, in the studio if you need a cable adaptor or an extra light, it's usually there. But all you have to work with in the field is what you brought along. If you're paying substantial salaries to actors and crew, you could run up a big bill if you lose a days shooting because you forgot the right camera cable.

But, if you have the right equipment, select capable willing people, and spend the time to have sufficient preliminary meetings with all your crew members, and thoroughly discuss your production and what everyone is supposed to do, your production should be very successful, and your technical problems will be minimized.

Typical Remote Production Concerns

Pick the right equipment Will your camera's 10-Pin cable connect directly to your VCR without modification? If not, can you get an adaptor or plug it in through the video input? But then you may need an extra person to turn the VCR on and off. How about power? Are your battery belts the right voltage and wired correctly for your VCR? Do you have enough extra batteries, and are they the right size and type?

Lighting Although there is usually adequate light outdoors, shadows, a cloudy day or interior environments may require artificial lighting for best results. Florescent light in particular is inadequate because its spectrum unpredictability will cause faces to be green and make camera balancing difficult. It's a good idea to bring a quartz light kit or two, and of course you will also need stands, clamps, diffusers, extension cables, spare bulbs and plug boxes. Each 1,000 watt quartz lamp will draw about 10 amps, and most circuits have a limit of 20 amps, so you may need special wiring or extra fuses.

Be well prepared for your audio In many ways audio is more difficult and troublesome than video, especially on a remote production. You will have a multitude of random sounds to contend with, and perhaps it may be difficult to get the mic near the subject. You may need a shotgun mic and a person to work it. Have spare cables, adapters and mics if possible, and a good set of monitor headphones is a must. Also, make sure you have the right type of microphone and the correct connectors on the cables. Be sure to bring spare batteries, extension cables and a mixer if necessary.

Pick the right crew There is no substitute for someone who really knows their stuff, like how to revive an intermittent microphone or power box on the job or how to tweak a camera for optimum color. A good tech can really save a shoot sometimes. It's also very helpful to have just the right number of people—enough to move cables, hold mics and operate VTRs, but not too many that they get in the way and create a distraction.

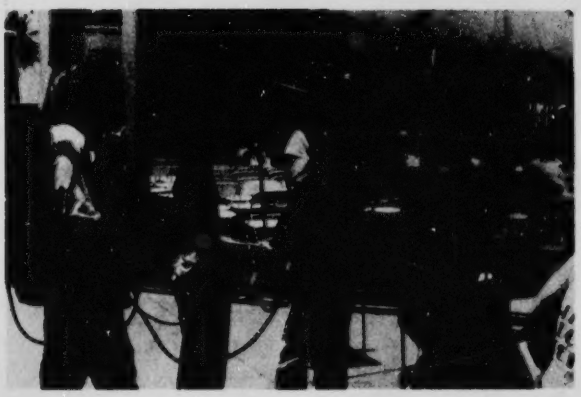
Check out your equipment beforehand Make sure everything works well *in advance* of the shoot and also check it the day before. Is everyone familiar with the equipment they are going to use. If not, have some training sessions in advance of the production date. Always arrive early enough to set up and test everything just before the shoot, and allow sufficient time to troubleshoot equipment problems.

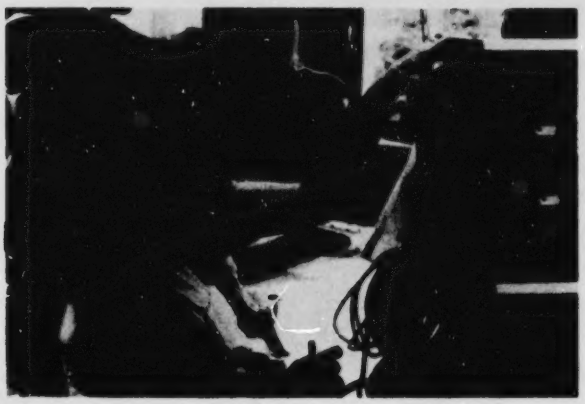
Communication If you are working out of a mobile van, some kind of van-to-remote-site communication is a must. Generally, a 2-way audio link called a PL SYSTEM is used between crew members on location and the director in the van. Unfortunately, these systems which consist of several 2-way headsets and an amplifying system usually die easily or become intermittent becuase of worn wires and connectors and heavy use. If major communication is lost, your production will fall apart rapidly. This is not a problem if you are shooting single camera style because you don't really need any intercommunication over a long distance.

Another communication problem can arise when shooting rock concerts or in noisy environments as this will make it difficult to hear the commands through the PL headsets. Consider headsets with padded earpieces.

The importance of co-operation A large remote production can be very complex technically and demanding physically, and this necessitates a real co-operative effort by all participants if the tapes are to be successful. Remote crews work best when everyone is "attuned" to each other and to the stated purpose and design of the program. The cameraperson, audioperson and director, in particular, must have a clear idea of what effect they want to accomplish, how to do this with their specific equipment and how to seek out and draw from their subject and environment the material the program requires.

It's important to try to work within the shooting environment as naturally as possible without contriving or altering it too obviously as this may negate the valuable impact of realism and credibility inherent in the natural environment. When you are able to pull together all the technical details and personalities involved in creating a successful remote production crew, you will find that your taping process will become much easier, and the overall experience will be one of excitement, professional reward and personal satisfaction.





Of course, there is much more to ENG than just cameras and portable VCRs. There's the whole package to consider—computer editors, time code generators and readers, TBCs, microwave transmission systems, mobile vans, etc. The subject of ENG merits at least one whole book. Unfortunately, space does not permit the treatment that this subject deserves; instead we must start a slow dissolve into a discussion of a slightly different aspect of video but one of crucial importance—"How to Keep it All Going," Troubleshooting, Maintenance, and Minor Repairs.

Chapter 14
Maintenance, Troubleshooting, And Minor Repairs

Like people, machines need love and care on a regular basis. If video equipment is kept in good health, the chance of a major breakdown and its associated expense will be minimized, and the equipment's life expectancy will be dramatically increased.

Since video cameras and TV monitors are nearly all solid state electronics, there's not much that can happen to them, unless they're dropped or a camera tube is burned. Multiple tube color cameras may occasionally need tube registration and electrical focus adjustments. Tube registration should be left to someone who knows what they're doing. VTRs, on the other hand, contain many moving parts and points of contact where videotape deposits can clog vital functions and metal surfaces can wear and become dirty.

A HEALTH CARE PROGRAM FOR YOUR VTRS

Cleaning the Recording Heads

The various video, control, and audio heads should be cleaned on a regular basis—every 8 to 10 hours of operation or so for a "quick clean" and a major clean at 20 or 30 operating hours. If a number of different people are regularly using the VTR, it should always be cleaned before you use it.

VTR Cleaning Equipment:

"QUICK CLEAN" Method—Reel-to-Reel VTRs:

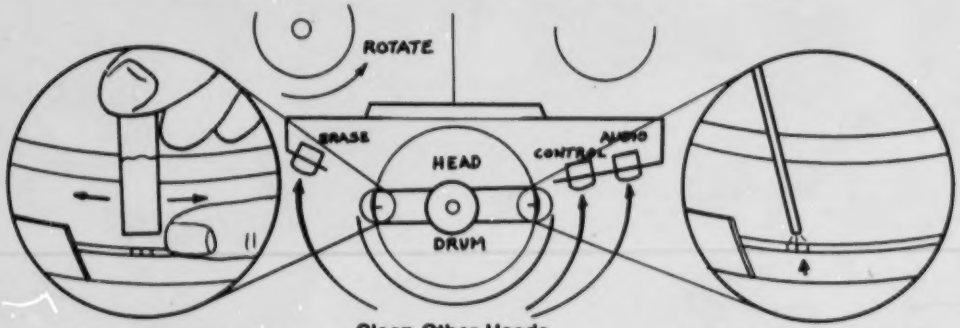
Step 1 Make sure the power is turned *OFF* and the rotating heads are completely stopped. The VTR should make no noise whatsoever.

Step 2 Turn the function lever to REWIND or FF mode.

Step 3 Remove the tape reels from the machine and slightly turn either the supply-reel spindle or the take-up-reel spindle until the video head rotates into an accessible position.

Step 4 Thoroughly spray the first video head with the tape cleaner and then rotate the second video head into position and spray it also.

NOTE: VTRs with rotary erase heads will have 4 heads to spray.



Major Clean Method **Clean Other Heads** **Quick Clean Method**

Step 5 Spray the surface of head drum (tape path area), and erase audio, and control track heads as well.

Step 6 Turn the FUNCTION LEVER to STOP and wait a few minutes for the spray to dry on the head surfaces.

Step 7 You can now turn the VTR back on.

MAJOR CLEANING METHOD

Step 1 Turn the VTR *OFF*. No sound should be heard from the VTR.

Step 2 Place the FUNCTION LEVER in REWind or FF mode and remove the tape reels.

Step 3 Rotate the supply reel spindle slightly by hand so the video heads swing into an accessible position—one at a time. They are located 180° apart.

Step 4 Spray the tape cleaning swabs with tape head cleaner or immerse them in denatured alcohol and gently rub each video head in a back and forth manner—*carefully!*

Step 5 Find a good light source so you can see what you are doing and clean the tape guide path. Clean all the stationary tape guides and surfaces which the tape might come in contact with. You can rub fairly hard on the surfaces of the stationary record and erase heads without risking damage.

Step 6 (Optional) Gently and carefully wipe off the head drum surface with a cleaning cloth or a lens cleaning tissue.

Step 7 Place the VTR FUNCTION LEVER in the STOP mode.

CAUTION: *NEVER* move the head cleaner *vertically* against the video heads.
NEVER touch the video heads with a hard object.
NEVER touch the video heads while they are in motion—The heads are brittle and will break easily.

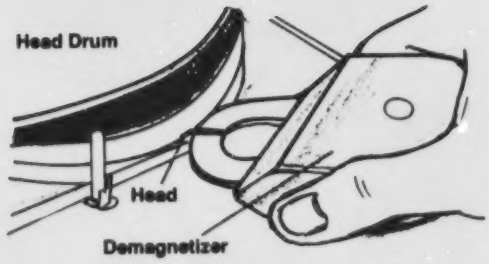
Cleaning the Cabinet

When the VTR cabinet surfaces become dusty or dirty, clean them with the provided cleaning cloth or other fine quality cleaning cloth. Never use solvents such as thinner or benzine as they may cause damage. Always wipe the surface of the head drum and tape path before and after operating the VTR near or on the sea or in a location where acid or alkali gasses are used.

Demagnetizing the Heads

If the VTR is used constantly, the heads may become magnetized resulting in poor picture quality characterized by excessive noise and grain. Use the standard head demagnetizer to rectify the problems.

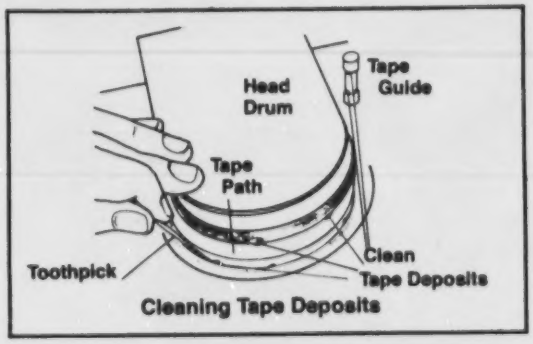
Place the head demagnetizer near each head (do not touch the head). Turn the demagnetizer *ON* and move it slowly away from the VTR and the recording head. Repeat this process 2 or 3 times for each head—both audio and video.



Demagnetizing The Heads

Removing Tape Path Deposits

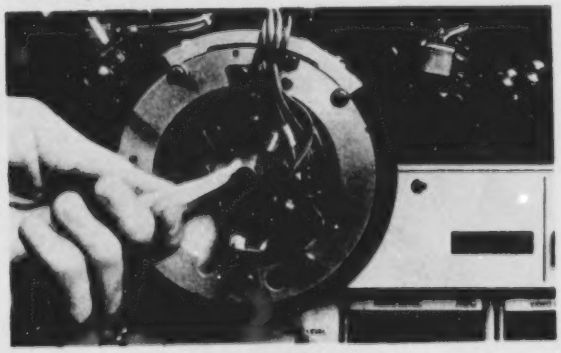
After 10 to 20 hours of use, deposits will build up in the corners of the tape path guides and around the head drum. Spray cleaner evaporates too fast to really remove any heavy deposits. Use a cleaning swab or Q-tip and saturate it with cleaning alcohol to dissolve the tape deposits and residue. Unfortunately, the swab cannot get into the tiny corners of the tape guides. A long wooden toothpick is excellent for this purpose. Clean around the edges of the tape guides and especially the *EDGES OF THE TAPE PATH* around the video head drum. The buildup of deposits around the head drum can easily cause mistracking.



Cleaning Tape Deposits

Cleaning the Slip Rings

All VTRs must have some means of transferring the picture information from the rotating video heads to the internal electronics of the machine. Most ½-inch VTRs use SLIP RINGS to accomplish this purpose. Occasionally, these slip rings must be cleaned, especially if the VTR is used in a dusty environment. Dirty slip rings will produce an effect in the picture playback much like tape dropout. The difference is that the black line of interference caused by a dirty slip ring will be constant and stay in one place in the picture, whereas the black line caused by a dropout will be only momentary.



Cleaning The Slip Rings

Dirty Slip Ring Signal

Slip Ring Cleaning Procedure

Step 1 Lift off the head drum protector by loosening the screws behind it.

Step 2 Carefully remove the 2 screws on the top of the head drum cover.

Step 3 Remove the cover.

Step 4 Turn the VTR ON and place it in the STANDBY or RECORD mode with the video heads rotating.

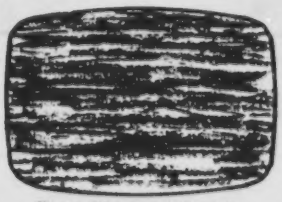
Step 5 Saturate a swab or small piece of paper in alcohol and apply the swab firmly to the revolving slip rings or insert the edge of the paper into the slip ring recesses. Continue the process until the swab or the paper ceases to accumulate dirt.

NOTE: Certain better quality VTRs have no slip rings. Instead, they use a more precise method of transferring the video called a ROTARY TRANSFORMER. The Rotary Transformer has no mechanical moving parts to create friction and wear, so it never needs cleaning.

CLEANING THE VIDEOCASSETTE RECORDER

Since neither the head drum nor the videotape is exposed to manual handling, cleaning the videocassette recorder becomes less critical than with reel-to-reel VTRs. Nevertheless, occasionally the unit should be cleaned as tape deposits will eventually build up on the head drum surface and the tape path guides.

One Clogged Head



Two Clogged Heads

Clogged Heads

Like a reel-to-reel VTR, the VCR has the same kind of circular head drum, rotating video heads, audio and control track heads and tape path guides. Poor quality tape, old or heavily used tape, or damaged tape can completely clog the video heads. One clogged head will display an entire picture but one with every other line missing or black. If both heads are clogged, the monitor will display only black and gray "noise." Sometimes these symptoms will last only for a short time and soon clear up as the tape continues to play. At other times, a major cleaning will be necessary to restore the picture. Special cleaning cassettes are available for this purpose.

Procedure for Using the Cleaning Cassette

Cleaning Cassette

Step 1 Insert the cleaning cassette into the VCR.

Step 2 Reset the tape counter to 000.

Step 3 Press the FWD button and watch the tape counter.

Step 4 Press STOP when the counter reaches 010. This should correspond to 30 seconds.

Step 5 Remove the cleaning cassette.

NOTE: *Do not rewind* the cleaning cassette after each 30 second use; wait until it reaches the end of the tape. It can be rewound and used over many times, but after prolonged use it will require replacement.

CAUTION: Do not overuse the cleaning cassette as it uses abrasives and may decrease the life of the machine.

Manual Cleaning of Videocassette Unit and Removal of Cover – ¾-Inch U-Matic

If the cleaning cassette will not restore the picture or if the tape is jammed inside the machine, it may be necessary to get inside the VCR. If you feel reluctant to do this, find a video repair shop or skilled video person. If, on the other hand, you want to tackle this yourself, proceed as follows:

Step 1 Make sure the VCR is turned *OFF*.

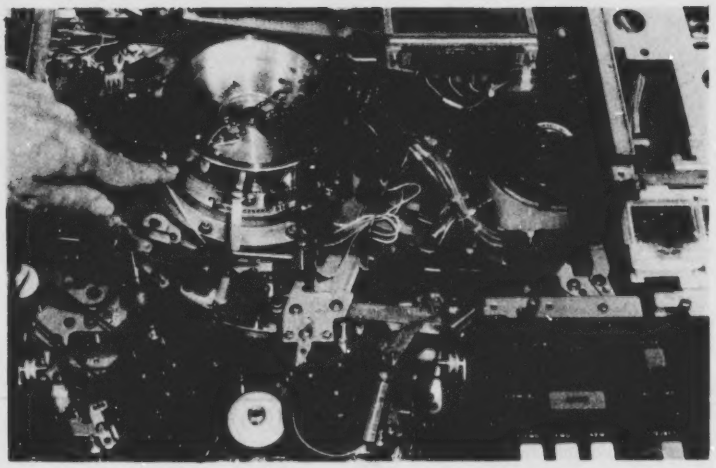
Step 2 Remove the screws from the back of the top cover. You will need a small screwdriver (Phillips with some, regular with others), or a METRIC Allen wrench for older Sony models.

Step 3 Carefully lift up the top cover, sliding it out HORIZONTALLY from the rear.

Step 4 Clean the heads and tape path guides just like you would do with a reel-to-reel VTR. See the first part of this chapter. Two features are unique to VCRs:

1) The entire video head assembly rotates with the heads. Merely turn the head assembly to locate the individual heads.

2) The control track and audio heads are hard to locate and clean. Follow the tape path to find the various heads and check for deposits on the tape path guides.



Video Heads Inside VCR

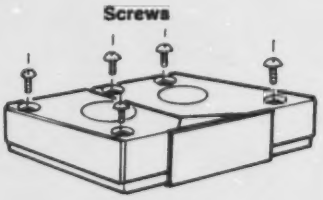
CAUTION: The tape guides are supposed to look crooked and bent—*DO NOT* try to straighten them out or you will destroy the tape threading mechanism and your tape!

Cassette Tape Repair Procedure— ¾-Inch U-Matic

If the tape becomes damaged or you have to cut off a piece which got jammed in the machine, repair of the cassette tape is as follows:

Step 1 Place the cassette down flat on a table with the back side up.

Step 2 Take out the 5 screws that hold it together. Use a Phillips head screwdriver and be careful with the front guide assemble screws. Remember how the screws are supposed to fit back in place.



Step 3 Remove the top cover of the cassette.

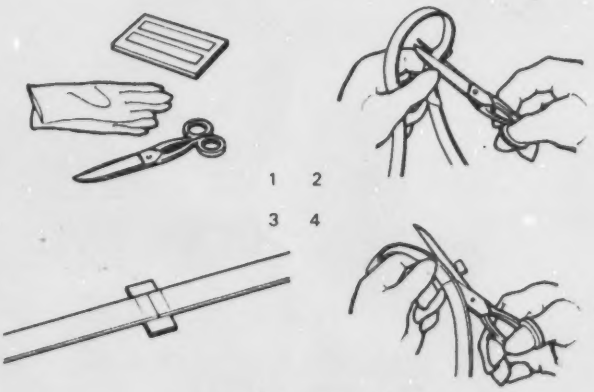
Step 4 Splice the remaining good tape together or onto the clear leader:

A. Cut off the bad tape and overlap the ends of the good tape together.
B. Cut the tape at a right angle.
C. Join the ends together.
D. Carefully apply the video splicing tape.
E. Trim the ends so no overlap exists.

NOTE: Use the video splicing tape only! *Never* use audio splicing tape!

Step 5 Rewind the tape carefully by hand back into the cassette, making sure the tape is threaded through the proper tape guides.

Step 6 Reassemble the metal tape guides, top cover and all the screws.



Tape Splicing Procedure

Head Cleaning Procedure—½-inch VCRs

½-inch VCRs can be cleaned just like the ¾-inch VCRs and will need new belts, brakes and major adjustments every 1,000 to 1,500 hours.

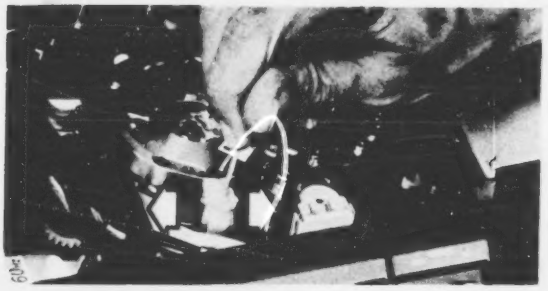
Step 1 Make absolutely sure the VCR is turned *OFF,* and no whirring sounds are coming from the VCR.

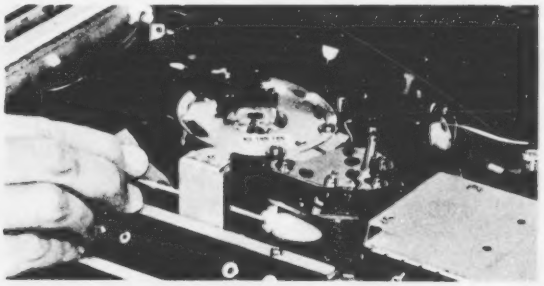
Step 2 Remove the screws from the top cover of the machine using a narrow-tip phillips screwdriver while being careful not to damage the screw heads. Next, remove the TRACKING knob from the front of the machine. It should pull or pry off the shaft.

Step 3 Press the EJECT button to raise the cassette compartment and carefully remove the cover from the machine.

Step 4 Clean each of the two video heads by rotating them into position by turning the motor fan shroud. This will rotate the entire video head assembly into position.

Step 5 Spray a cleaning swab with the head cleaning solution. *Very carefully* clean each head by using a back and forth *HORIZONTAL* motion *only* in the same plane as the tape travels. *DO NOT rub the video heads vertically as this may easily cause severe head damage.*





Step 6 Clean the video erase, audio and control track heads. On Betamax VCRs, these heads are located in the large assembly next to the circular head drum. VHS machines have the heads located on the tape path to the right and left of the head drum cylinder. Spray the swab with the head cleaner, and clean the heads and tape guides until all deposits have been removed.

Step 7 Replace the cover and all knobs on the VCR. Turn the machine on, and play a tape to confirm that everything is working ok. If it isn't, repeat steps 5 and 6.

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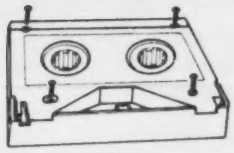
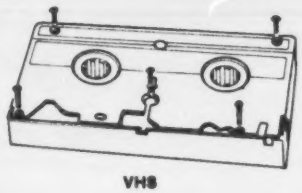
½-Inch Cassette Tape Repair Procedure

Step 1 Use a narrow-tip phillips screwdriver to remove the screws that hold the cassette together.



BETA



VHS

Step 2 Carefully grasp the cassette and turn it over so the label faces you.

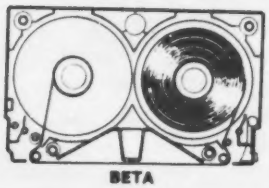
Step 3 Depress the front panel release catch on the left side of the cassette, and open the tape protector panel.

Step 4 While holding the spring loaded tape protector panel open, carefully lift the top cover of the cassette off the body of the cassette.

Step 5 Splice the remaining good tape together or onto the leader using the method mentioned earlier for ¾-inch tape.

NOTE: Use video splicing tape only. *Never* use audio splicing tape.

Step 6 Rewind the tape carefully by hand back into the cassette, making sure the tape is threaded through the proper tape guides.



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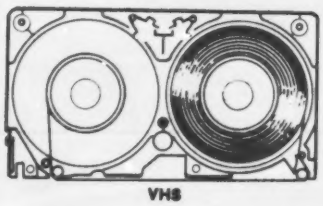


VHS

Step 7 Reassemble the cassette, replace the top cover and all the screws.

Maintaining Correct VTR Tension

Another important operating parameter in any VTR or VCR is its tape tension (skew). With use, the tension will change as belts, rollers and wheels wear, and in extreme cases, incorrect tape tension will cause flagging at the top of the screen during playback. Tension errors will of course be recorded into tapes recorded on a malfunctioning machine. To check your machine's tension, a company called TENTEL of 50 Curtner Ave., Campbell, CA 90058, makes a tension gauge called a TENTELOMETER for ¾-inch and ½-inch VCRs. The cost of the unit is $195, and clear and concise instructions for measuring your machine's tension are included in the kit. This device would be very helpful to heavy VCR users who are concerned about tape quality control.

Tentel Tension Gauge

Threading Mechanism Malfunctions

If a VCR experiences extremely heavy use, the roller that drives the threading chassis on older VCRs may become worn out, causing the machine to stall halfway through threading. Replacement of this roller is tricky, and it should be referred to a competent video repair person. Another serious problem results if the automatic shut-off and de-threading mechanism fails at the end of the tape. The tape will stop and remain locked around the video head causing friction against the video heads which soon destroys them. If you notice that the tape stops at the end of the reel and the machine does not de-thread immediately, shut down the machine at once and take it to a competent repair facility. *DO NOT* attempt to remove the cassette.

TROUBLESHOOTING

Psyching Out the Machine

Unlike people, machines can't tell you where it hurts. They just suddenly or intermittingly cease to function. When this happens, *PATIENCE NOT PANIC* is the approach to take.

Human Error

Most problems are due to simple human error; probably 80% to 90% of all malfunctions stem from tape misthreading, cables plugged into wrong inputs or outputs, or switches placed in improper modes. *CHECK THESE THINGS OUT FIRST!*

PATIENCE, NOT PANIC

Mechanical and Electronic Malfunctions

The other 8% to 10% of machine problems are due to mechanical failures such as broken plugs or wires, dirty heads, broken switches, etc., which a good mechanically inclined person can fix personally. The remaining 2% or so are due to electronic problems such as component failure, which take a competent VTR service technician and the proper test equipment to fix.

Cosmic Interference and Mental Attitude

Then every once in awhile, strange things happen; usually the "come-and-go" type where your system will suffer severe picture distortion, horrible color quality, or loss of audio minutes before or during the big production. The VTR operator and director often experience waves of nausea and acute mental hallucinations usually accompanied by recurring questions such as "Why me?" or "What did I do to deserve this?"

Assuming everything is properly connected, there is another cause to consider. Even so-called inanimate matter such as electronic circuits and pieces of metal and plastic are all made up of atoms and molecules that must bind together in a certain absolute pattern. A kind of INTERNAL INTELLIGENCE and energy is necessary to maintain this pattern. A VTR has a great variety of moving parts and must maintain a vast multitude of precise electronic levels and critical tolerances that must all function together perfectly 100% of the time. The slightest deviation in one component's performance will often adversely affect all the rest.

The internal intelligence of VTRs and cameras will definitely respond to highly negative or positive emotional fields generated by people. Like organic matter such as plants, animals or people, a video system will respond well to those operators who approach it with care and love. An overly frustrated or negative person will pass those personal frustrations onto the equipment and

"strange" failures will inevitably result. This is why equipment "works" for certain people and "doesn't work" for others. *It happens every time.* Thus COSMIC INTERFERENCE may be *your* problem rather than the machine's. If you're convinced the equipment will break down on the job, it definitely will. Be prepared for all contingencies, but approach your production with a positive mental attitude.

General Principles of Troubleshooting

When things don't work very well or refuse to function at all, try these general principles of troubleshooting in order. Remember—*BE PATIENT, DON'T PANIC,* your problem is probably due to human error.

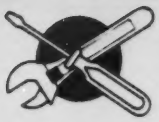
1) **Start from the beginning again.** Unplug everything and plug it in again. You may have your VIDEO INS and VIDEO OUTS mixed up or a plug may not be plugged in all the way.
2) **Rethread the videotape.** Check the threading diagram on the cover of the VTR.
3) **Start with what you know works.** Substitute a second cable, VTR, camera, monitor, or microphone that you know works—substitute one at a time and see what happens.
4) **Isolate the Malfunction.** Through substitution of a component, you should be able to isolate the problem area. If nothing works, check your main power source and try other batteries and/or AC plugs. Check for power switches that are turned off, blown circuit breakers or fuses.

Troubleshooting Reference Chart

Symptom	Probable Cause	Solution
Unit does not turn ON or	dead battery with portable VTR	recharge or replace battery or use AC power
	VTR is not plugged in or switch not turned ON	plug in and turn ON
	auto shut-off mechanism is jammed	rethread tape and fix mechanism
	fuse circuit breaker in AC system blown	replace fuse or reset circuit breaker
	fuse in VTR blown	replace fuse
No picture on camera	camera cable problem cable not plugged in	check cables or use substitute cable
	camera or VTR is not turned ON	turn camera and VTR ON
	batteries dead	replace batteries or use AC power
	beam or target control on camera improperly adjusted	reset beam and target
No picture on camera viewfinder or monitor when VTR is in E to E mode (VTR is ON)	VTR monitor connection is faulty	substitute new cable
	monitor mode switch in TV mode	switch to VTR or LINE mode
	wrong cable connections	check cables
	faulty plugs or connectors	check or substitute other plugs or connectors
	source selector switch on VTR is not in the proper mode	source or input selector switch should be on LINE on most VTRs and CAMERA for some—try both positions
	video level control turned OFF on VTR	switch video level control to AGC
no picture or loss of sync	INT/EXT sync switch on camera in wrong mode	try INT sync

Symptom	Probable Cause	Solution
Interference in picture during camera monitoring	COLOR/BW switch on VTR in wrong mode	select correct mode
	faulty cable connection	replace cable
	AC cables too close to video cables	move cables
	AC power cables not grounded	use 3-prong plugs and connections only; ground 3 to 2 prong adaptor or reverse polarity of 2-prong plug (reverse the prongs in the socket)
spots or black squiggly lines in picture	dirt on camera tube or burned vidicon	clean lens and tube faceplate or replace tube if severely burned.
distortion or interference during picture playback	dirty heads	clean heads
	tape improperly threaded	rethread tape
	dirt in tape path	clean tape path
	dirty slip rings	clean slip rings
	COLOR/B&W switch on VTR in wrong mode	select correct mode
	high-density tape mode switch in wrong position (AV-8650 Sony and NV-3160 Panasonic)	try other mode
	Source or Input selector switch on editing VTRs with capstan servo is in TV mode during playback	switch to LINE or CAMERA mode or push SYNC DEFEAT switch during playback
	tracking poorly	adjust TRACKING control
	tape faulty or old—has too many dropouts	replace tape
	damaged video heads or control track heads	replace heads—take to VTR service co.
	wire tape guides on certain Sony VTRs bent	realign or replace
distorted or loss of sound	faulty microphone connection	check or replace cable
	bad or reversed battery in condenser microphone	replace or reverse battery
	audio controls on VTR turned OFF	turn on audio control/limiter or AGC
	wrong connection	microphone should be plugged into MIC IN or mixer should be plugged into LINE IN on VTR
persons receive shock when touching microphones	wrong polarity	reverse AC connections of mixer or VTR system
Radio noise in audio	radio station nearby	shield audio and video components with copper screen or aluminum foil; uncoil audio cables or move audio cables away from AC cables

NOTE: If all else fails, reread the instruction manual and try again a few days later. If your second attempt doesn't produce results, take the equipment to a good repair facility.



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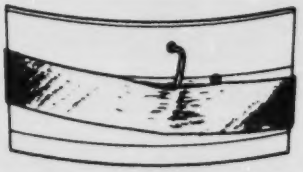
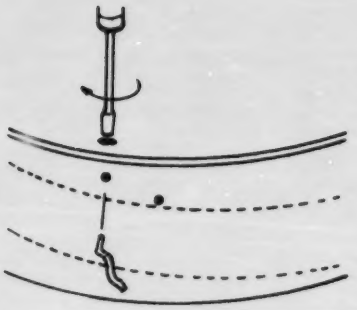
Realignment of Wire Tape Guides—Sony AV-8650, 8400 and other late model VTRs

Correct



Damaged And Bent



Replacement

To fix—turn VTR OFF and use needle nosed pliers to bend guide out of tape path. Replace guide by removing video head cover, and use a jeweler's screwdriver to remove and replace the guide assembly.

Special Videocassette Recorder Problems

Machine Eats Tape—Occasionally the tape guide will get off the track and wind the tape around the capstan roller. Usually the machine will then shut down. Make sure the VCR is turned OFF. Proceed to remove the VCR top cover, and *very carefully* try to *gently* remove the miles of tape that have filled the interior of your machine. You may have to cut the tape with scissors as it is now useless anyway. Once the crinkled tape is extracted, throw it away. You may also have to clean the machine afterwards.

If a certain VCR continually eats the tape, try another brand of cassette tape. If it eats that one too, try the "bad" cassette on another similar (same manufacturer) machine. If the tape works fine on the other VCR, the problem is your machine. If several similar VCRs all eat the tape, the chances are that this particular cassette tape has some bad spots in it or is defective. Consider switching to another brand tape. If you still have problems, consider switching to another profession or job.

Tape Winding and Storage Problems

Sometimes a VCR will shut off and de-thread in the middle of a tape playback for no apparent reason. This is usually due to excess slack in the tape created during storage of the cassette. The automatic sensing mechanism in the VCR will sense the excess slack and shut down the machine automatically. Because the tape reels overlap on a ¾-inch cassette, the uneven weight of the tape on the reels causes it to produce excess slack, stretching and other problems—usually during storage. Cassette tapes should always be rewound after use. It's also helpful to fast forward and rewind the tape several times before playing or recording. This will eliminate slack.

No Picture or Recording on TV Set or Monitor in RECORD Mode

Check the bottom of the cassette for the red recording lock-out button. The button must be in place before the VCR will go into the RECORD mode. On JVC machines, make sure the switch on the back panel of the VCR is in the VIDEO IN/AUDIO position instead of the TV mode. Also on JVCs, make sure the ANTenna SELECTor switch on the top of the VCR is in the VCR position.

Importance of a Regular Maintenance System

HORACE'S LAW OF VIDEO VENGEANCE:

"Equipment breakdown and repair expense increase directly with the number of different people who use the equipment."

Individuals who own their own video equipment and regularly maintain it can go for years without any major repair. Large groups, particularly students that use equipment, are always complaining about how nothing ever works. Several key persons should be designated to clean and maintain the equipment on a regular basis in a group use situation. Some discretion should be used when loaning out VTR equipment to untrained persons.

Chapter 15
Setting Goals And Purchasing Video Equipment

Perhaps the most difficult but one of the most necessary disciplines involved in the video or TV process is the definition of one's goals. Just what do you want to accomplish with the video equipment you have already bought or are preparing to buy? It's all too easy to buy, buy, buy, without seriously considering what you intend to do with the equipment. The sad result can be thousands of dollars spent on a video system that will sit in a closet because it is either inadequate or too difficult to use.

Eager video equipment salesmen often contribute to the problem when they tend to show more interest in selling lots of hardware rather than helping the customer really define his production needs. But, where do you start? You may feel you won't know how you can use video until you've had a chance to use the equipment for awhile. In any event, you must begin somewhere, right?

GETTING INTO VIDEO—CAREFULLY!

Step 1 Research

Visit others who have video systems and are producing programs similar to your own concepts. Ask them what problems they had and how they achieved successful results. Discuss the technical equipment they purchased, how dependable it has turned out to be, and how responsive the equipment dealer has been. Keep in mind though, that someone else's system may not be suited to your needs. Every video user is an individual, and you probably have specific applications that require a unique package of equipment.

Be prepared to take whatever amount of time is necessary to educate yourself about the equipment. Consider all the factors that go into deciding what you really need, and then establish a good relationship with a reputable video dealer. Purchasing the right equipment is a major project, and it demands considerable thought and data gathering.

Step 2 Group Discussion and Analysis

Have several meetings with *ALL* the people you plan to be working with or for whom you will be making tapes. Invite *EVERYONE* to discuss project ideas and expectations. Although only one or two persons will really have to make all the major decisions and gather all the important data, it helps to have a variety of input at the beginning of the process.

Step 3 Definition of Expectations

This is the critical phase of planning as expectations tend to be abstract and must eventually be related to financial and practical reality. One person may wish to do ambitious remote productions necessitating sophisticated editing equipment. Another will have visions of elaborate video animation, while a third may describe a program concept that requires a full scale color studio.

There are numerous levels of program sophistication each requiring certain kinds of video equipment. Almost anyone can point a video camera at an object and get a picture, but it's a whole different matter to produce a cleanly edited sophisticated video program with a good sound mix. Such a program requires a great amount of time, proper equipment, careful planning, and a substantial personal commitment of energy and effort.

Once you have received the input from those people who will be using the equipment, you need to come to an understanding of what you really do want to accomplish. Ask yourself what you are trying to communicate, and to whom are your programs going to be addressed. Try to write this down as a statement of "Goals and Purposes of TV Production Facility," so you can really be clear on this in your own mind.

Step 4 Selecting Equipment

When you think you know what you hope to accomplish, you next might want to consider what mix of video equipment will best suit your needs. Outdoors remote shooting is much more effective and colorful than the studio-type TV program. So, most people find the portable system the best way to start.

Proceed slowly at first. It doesn't require a full scale color studio for third grade students to make their own tapes. A simple black-and-white single camera system will be adequate for the job. Perhaps the Vocational-Ed Department wants to make training tapes. A black-and-white or color portapak and ½-inch or ¾-inch editor would work well at a minimum cost, or perhaps a small color ¾-inch studio set-up would be the way to go. A ¾-inch color portapak could be used to shoot remote footage which could be integrated into the program during editing or with a SEG having a genlock capability. If your organization intends to produce hundreds of training tapes for national or international distribution, you will probably need a sophisticated mobile van and/or studio, and perhaps quad mastering and computer editing.

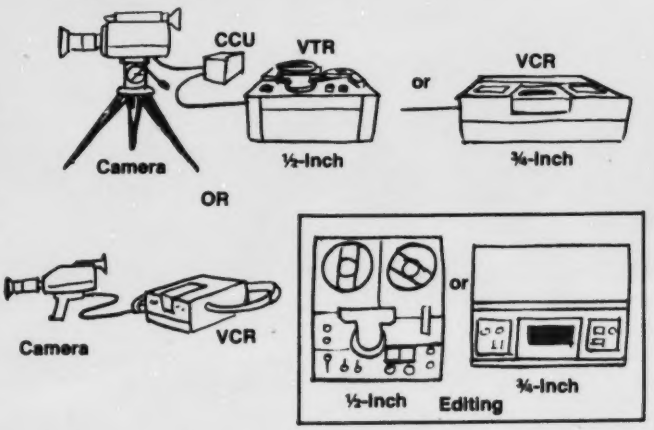
In any event, try to consider the most flexible arrangement of equipment that will satisfy the majority of your production needs and that will fit within your equipment and personnel budget.

Some Typical Systems

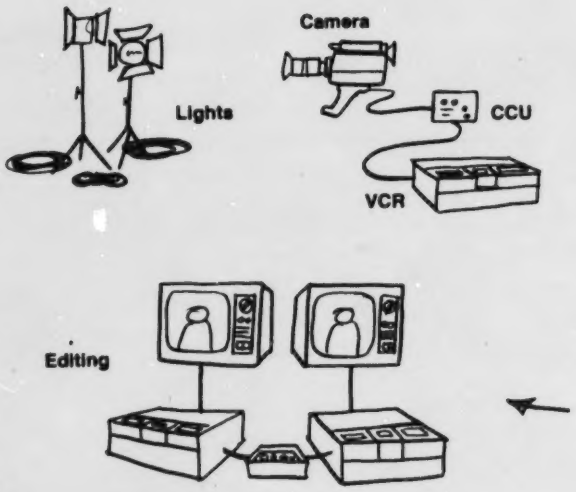
Starter System:

The usual starter system is a portapak, or single camera and VTR system with possibly an editor VTR as a second VTR. The portapak and editor give you good production flexibility as you can shoot indoors or outdoors, on battery or AC power, and edit your prerecorded tapes on the editor. With a good VTR editor and a sense of editing esthetics, you can produce a professional looking tape. Probable costs are $2,000 to $5,000 in b&w and $9,000 to $25,000 in color for the complete starter systems. The basic system is simple enough to require very little maintenance and only part time technical personnel.

Starter System

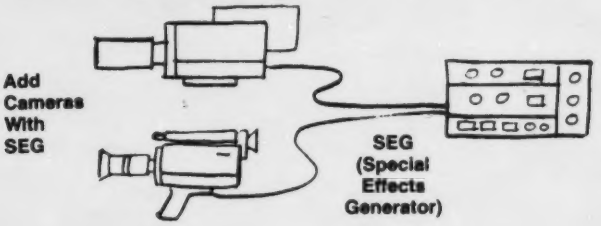


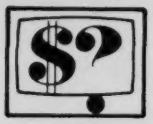
Mixed System #1



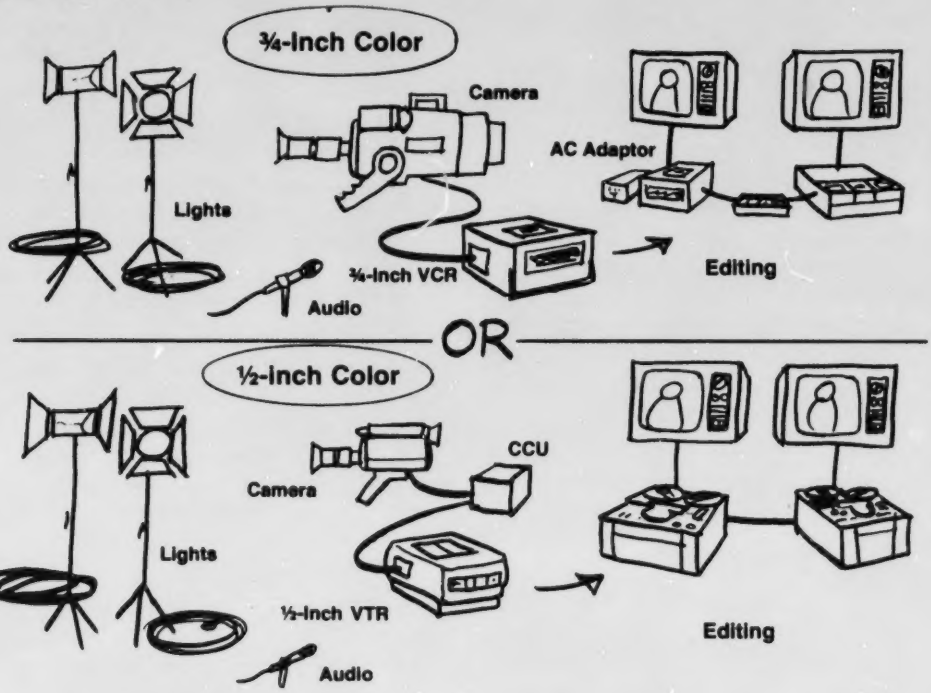
Mixed System No. 1:

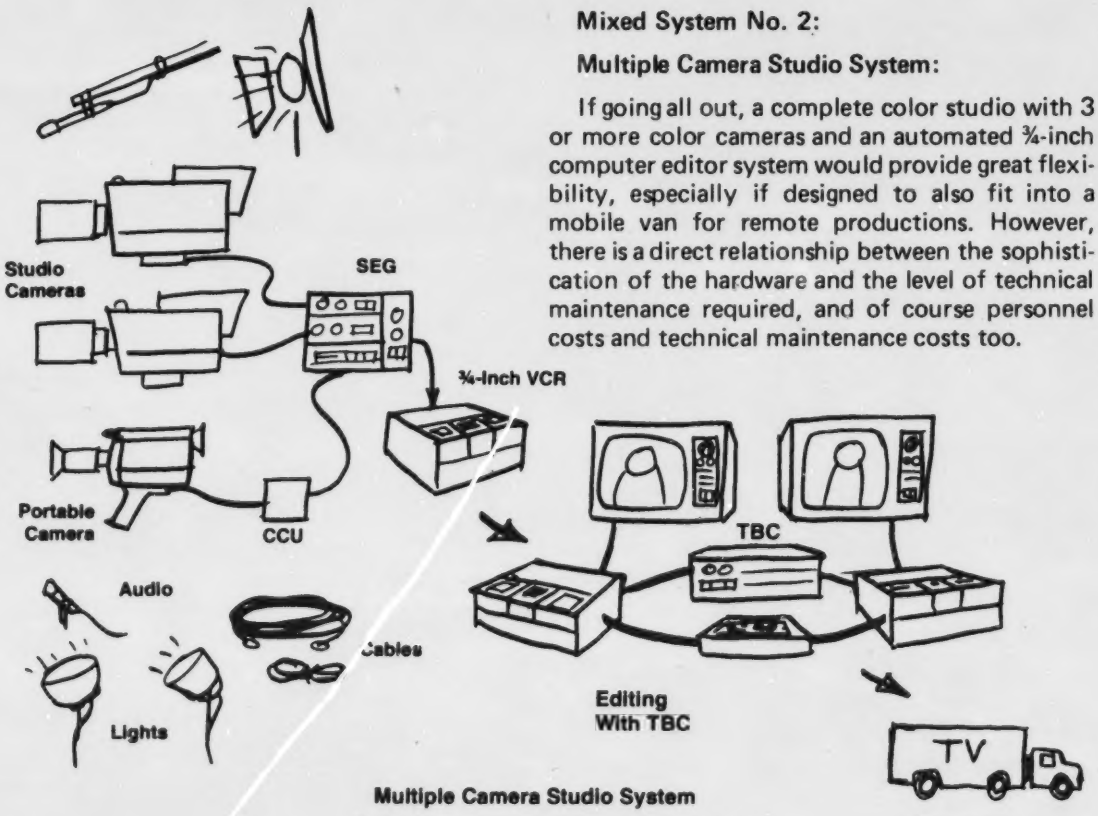
A moderate price "mixed" system will probably meet the bulk of most user's needs. The equipment would include: portable or studio color camera, a recording VTR, a lighting kit, and audio accessories to be used for shooting, and an automatic backspacer editing system for editing. The mixed system can easily be upgraded by adding more cameras and an SEG. For additional versatility add a portable camera and a portable VTR.





Mixed System #2





Multiple Camera Studio System

Mixed System No. 2:

Multiple Camera Studio System:

If going all out, a complete color studio with 3 or more color cameras and an automated ¾-inch computer editor system would provide great flexibility, especially if designed to also fit into a mobile van for remote productions. However, there is a direct relationship between the sophistication of the hardware and the level of technical maintenance required, and of course personnel costs and technical maintenance costs too.

A full scale studio will require a crew of no less than 4 or 5 people and a full time video engineer. Figure that the equipment could cost $50,000 to $150,000 plus the expense of buying and outfitting the mobile van. This is the Ferrari of video. Great performance but it needs constant attention and lots of "tweaking."

Once you have decided what equipment you need, get brochures from dealers and have them demo the equipment for your people. See if the quality is acceptable to you and if your people can comprehend the equipment and will use it. Read the technical specs of the equipment and compare them with the specs of similar equipment. There may have to be a trade-off of certain features for costs. You will have to decide what is most practical and cost effective for your purposes.

Step 5 Writing the Specifications

When you know what you want, write it down on paper in the form of a SPECIFICATIONS DOCUMENT or LIST OF SPECIFICATIONS. This document should comprehensively define what you want to happen. Don't worry about what specific model equipment items you need—the dealer can figure that out and tell you what camera systems, VTRs, and black boxes are required for the job. Eventually, you will end up with an EQUIPMENT PACKAGE that includes everything technical that you need to accomplish your specific production goals.

Step 6 Check into Servicing Availability

A very important element in your equipment package is the servicing component. Who will nurse your VTRs back to health when they throw a belt, bust a head, or hemorrhage a transistor? As part of any equipment purchase, no matter how small, you should consider servicing availability.

Know your servicing capability. If you have an in-house technical repair staff, have them involved in your original equipment discussion sessions so you know what their capabilities are. If they have trouble with record players and audiocassette recorders, don't let them even take the cover off your VTRs. If they seem competent, but wary, consider a technical training package as part of your over-all equipment deal.

Warranties—Generally, most video equipment has a *90 day labor/one year parts warranty*. However, the warranty is valid only through authorized video dealers who handle factory parts. If you replace a factory part yourself, you may invalidate the warranty. Warranties are valuable when valid, and any factory authorized dealer must make good on them. Therefore, the dealer is a crucial link in the chain.

Find out his parts availability, technical competence, and what your down time might be. Will he just send your equipment off to the main repair facility in California or New York, and you are without your editor for 3 months, or will he fix it at his shop and provide you with a loaner while he sends for the necessary parts? And most importantly, is he an authorized factory service outlet?

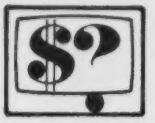
Service Manuals—If you are doing your own repairs, or plan to purchase modified equipment, make sure you have the appropriate SERVICE MANUALS. These cost money, but will pay for themselves many times over in reduced labor and parts costs. Write the service manuals into your equipment specification package.

Delivery Time—Generally, it takes 60 to 90 days to deliver a big system, but a portapak or two can be delivered in a week if in stock. Write your required delivery time into your spec sheet and consider adding a penalty clause for late delivery if you think it is necessary.

Package Buying—You can get into trouble here because no single manufacturer makes all the best of everything. Allow yourself the flexibility to purchase individual equipment items.

Step 7 Selecting Equipment

First and foremost, only consider a recognized brand of equipment made by a company that is a *leader* in the field. This insures that you will experience minimum hassles, that you will have technical support when you need it, and that the equipment will actually work. A leader becomes a leader only if he can successfully supply customers with what they need over a long period of time. *Avoid* modified equipment as this almost always leads to a real quagmire of problems from which you will never escape technically or psychologically.



Mixing Components—Generally, it is not a good idea to mix components within a specific system. If you buy a Sony VTR, it will usually work best with a Sony monitor and a Sony camera. However, you may want to mix your Sony video equipment with other brand accessories, such as Colortran lights, a Miller tripod or a Sennheiser shotgun microphone.

Beware of items that may not be compatible with your equipment, and if you decide to purchase them anyway, get the dealer to be responsible for these product items and fix them if they should die. Any modifications should definitely be the dealer's responsibility. Find out if he will still honor the manufacturer's warranty on the "dealer modified" equipment. *Whatever you do, don't buy serial No. 001 of anything!*

Step 8 Selecting a Dealer

It all eventually boils down to the *integrity* of the dealer. Is he honest? Will he support you in time of need? The ways to find this out are basic:

- Is he a specialist in video or is his main preoccupation TV sets and stereo equipment and/or a muffler shop down the street?
- Does he have a track record of other happy and contented video users?
- Is he an authorized equipment dealer and service representative?
- Is he *responsive* to your needs?
- Does he return your phone calls and ask you intelligent questions?

Gather all the available data and then apply your common sense.

Use of Consultants—If you are contemplating creation of a major TV production facility, by all means consider hiring a consultant. The consultant may cost from 1% to 10% of the cost of your total system, but if you don't know what you are doing, the consultant may be a wise investment. The consultant will write the specs, evaluate the dealers and their bids, work with them and evaluate the delivery and installation, and even train your personnel.

You could ask the dealer to do some or all of these tasks if he is qualified, but beyond a certain point, you should arrange to pay him a fee, especially if the project will go out to bid.

Step 9 Bidding

The concept of competitive bidding has some merits, but it can be extremely dangerous under certain circumstances. If the lowest bid is the sole criteria, you may be walking into a disaster. Often a low bid from a dealer means lower overhead which may very well mean poor service or no service at all. He has to make a profit somehow.

Check out the itemization and costs of each item of equipment, and look for substitute non-brand items. Specify that the Vendor be a factory authorized dealer. Carefully specify your servicing and back-up requirements, but don't be unrealistic—no dealer can fix your equipment for free for 2 years or provide equipment loaners forever.

Remember—you get what you pay for. The lowest priced bid may easily be the worst deal and the most expensive bid may be the best deal. Don't let the bid process be your downfall. Also consider penalty clauses for inadequate service.

Step 10 Purchase the Equipment, Set it Up and Make Tapes!

Equipment Life Expectancy and Resale Value

Choosing video systems is a difficult matter even for the experienced user, because there are so many choices and complex factors involved. Also, the state-of-the-art changes rapidly, making it a real challenge to predict what system will be the most economical and useful over the years to come.

Fortunately, good major brand video equipment, especially Sony, retains its value and in some cases may actually appreciate. This is less true with color cameras as they are evolving much more rapidly than VTRs and monitors. If the equipment is properly cared for and it was purchased at a good discount, chances are you will lose very little money when you sell it 5 years later. The actual life span of video equipment has yet to be determined, because some units tend to become obsolete before they wear out. The only parts that wear are video heads, belts, and motors which can be replaced almost indefinitely. Everything else is solid state electronics. Old pre-EIAJ standard video equipment (1967-1969) still lives on in elementary schools after having been well used by colleges and high schools over the years. Old video equipment never dies, it just gets handed down to the elementary schools or kindergartens.

THE BIG DECISION

For low to moderate budget production folks, the first major decision concerns which format to use, ½-inch or ¾-inch. The cameras and monitors are essentially the same for both formats so that's no problem, but the master recording and editing equipment will be different.

½-Inch EIAJ Reel-to-Reel or ¾-Inch Videocassette?

The ½-inch EIAJ reel-to-reel or open-reel format substantially preceded videocassettes and videocartridges. Over the years, the reel-to-reel format has been updated and considerably evolved. Many veteran users of video systems prefer the flexibility and handling characteristics of the open-reel technology. All the really sophisticated super expensive broadcast production systems are of the reel-to-reel types. For small-format users though, the ¾-inch videocassette format offers better color quality and far more sophisticated editing control than ½-inch reel-to-reel technology. But ½-inch VTRs are cheaper, easier to repair and offer better economics for the low budget user. Many people have already made considerable investment in ½-inch technology, and the machines themselves may last for 10 or 15 years with a few rebuilds along the way. So the ½-inch open reel VTR will be with us for a long time to come even though many ½-inch open reel machines have been discontinued.

½-Inch or ¾-Inch Videocassette?

The ½-inch videocassette equipment will eventually replace the ½-inch EIAJ open-reel system. Being a more advanced and more economic medium, the ½-inch videocassette offers many advantages. For low cost program distribution, it can't be beat, but it is not intended to be a high quality master production medium yet and thus does not offer the sophistication nor the total system flexibility of the ¾-inch format. However, ½-inch VCRs offer many valuable features such as random access playback, programmable recording and playback, portability, ease of operation, excellent reliability and low cost.

Crucial Technical Factors

Image quality—¾-inch Type II VCR systems are at the very least 30% and possibly 100% better than ½-inch VTR/VCR systems in terms of color reproduction and recording capability.

Image and Sync Stability—Again the ¾-inch VCR rates very high marks in this category also. Improved tracking and skew systems in the VCRs, and the tape scanning method, greatly aid tape interchangeability among other ¾-inch VCRs. Tape compatibility and stability is always a potential problem with the ½-inch EIAJ VTRs, as the tracking and skew controls must constantly be adjusted. The interchangeability of ½-inch VCRs is also better than that of ½-inch EIAJ VTRs.

Dependability—Since the ¾-inch and ½-inch VCRs are newer designs than the ½-inch EIAJ VTRs, and manual tape handling has been eliminated, their dependability rating is much higher.

Flexibility—The ¾-inch format has a sizable lead on all ½-inch systems in the flexibility category. The dual sound tracks of the ¾-inch VCR offer a substantial advantage over the single sound track on the ½-inch systems for sound dubbing, mixing and editing purposes. However, ½-inch EIAJ editor VTRs are easier than ¾-inch VTRs to manual backspace for editing. Accurate VCR editing is all but impossible without an automatic backspacing programmer.

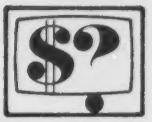
Portability—Excellent portable systems are available in all three formats. The ¾-inch portable VCR is generally heavier but much easier to use than the comparable ½-inch EIAJ portable VTR. The ½-inch VCR portable is the lightest and simplest machine of all.

Editing — Editing poses special problems for VCRs. An automatic backspacing system is almost a must, and such a system complete with an automatic programmer and 2 VCRs will start at $9,500. In the ½-inch EIAJ format, you could make do by using a b&w or color portapak for playback and a good VTR editor at a total cost of less than $5,000. When getting into the big computer editing systems, anything is possible with the ¾-inch format. Also, certain Sony Betamax ½-inch VCRs can be interfaced with certain Sony ¾-inch editing VCRs and automatic editing programmer systems.

Ease of Operation—Because of the automatic threading mechanism used in the ¾-inch and ½-inch videocassette systems, they are considerably easier to use than the open-reel machines. This feature alone may mean that people will actually use a video machine rather than leave it in the closet to gather dust.

The 1-Inch VTR Format

The 1-inch reel-to-reel format has always been intended for high quality master recording and editing—generally broadcast applications or major educational/industrial systems. Since 1976, a new generation of 1-inch reel-to-reel VTRs has been created in the $20,000 to $80,000 category to attempt to rival 2-inch quad VTRs in quality and



VTR Cost Comparison Chart

	½-Inch EIAJ (reel to reel)	½-Inch VCR All color	¾-Inch VCR All color	1-Inch All color
Portable VTR without camera	$1,200 b&w $1,400 color	$1,200 b&w Akai VT 300	$3,000	$30,000
Record Play VTR	$1,000 b&w $900 $2,500 color	$1,100 color	$1,500	$35,000 $20,000
Editor VTR	$1,400 b&w $2,800 color		$3,600 $10,000	$20,000 $80,000
Tape (60 min)	$20 $25	$16 $22	$25 $25	$50 $80
Tape (30 min)	$12 $20	$16 $22	$18 $25	$30 $40

flexibility for master recording and editing. These high-quality 1-inch systems by Ampex, IVC and Sony are very sophisticated production machines and should be considered by anyone contemplating a top quality color production facility. *See Chapter 9—VTR Interchangeability.*

Overall Comparability of Formats

For the best picture quality, production and editing flexibility, ease of operation and state-of-the-art technology, ¾-inch U-Matic or 1-inch (for special applications) is the only way to go. If on a tight budget or dealing with marginal economics, the ½-inch format could be perfectly adequate if the programs being produced are not intended for large scale distribution. ½-inch is a fine format for simple productions. A distribution system set up on ½-inch can save considerable expense in initial purchase and will also save on on-going tape costs relative to ¾-inch.

The Best of Each Format

Don't be afraid to use the best of each format. Usually any serious video production facility will find ¾-inch a must for mastering, editing, and also dubbing and playback. However, you may want to distribute your programs on ½-inch videocassettes. An intelligent mix of systems can allow you to make use of the best features of each format.

THE ULTIMATE VIDEO CHALLENGE

By now you should have a good grasp of the recording technology, what it can do, and how to make it work successfully. But the real challenge and enjoyment comes from actually making your own tapes.

In order to get your images and emotions down on tape, you need to deal with a multitude of physical, psychological and creative factors. People, money, and machines must be all orchestrated together in concert. Disharmony has no place in the video production process. Remember, there is a human side to the video process, so don't be concerned only with the machines and lose sight of the people. Both elements deserve equal consideration and attention.

The process of drawing all these diverse elements together and materializing your production ideas into physical reality can be an immensely rewarding experience. You can communicate with those masses out there and have them share your ideas, information, insights, fears, frustrations and happiness. All you really need is a good production idea, a portapak, and a technical understanding of your equipment. Soon, you will have *your message* on tape which can be processed and copied indefinitely and sent out into the world—as sort of an electronic bottle message cast into the great sea of curious, information-hungry humanity.

Video as well as TV is a tool of communication that offers a mind-boggling potential. Satellites and portable home videocassette systems could be linked together to put people in touch with each other—technologically. But the communication technology can create no sensitivity of one human to another unless each has gained some awareness of himself or herself first. For us to use television to enable people to know themselves better and to learn to become cognizant of their intimate relationship to humanity, the planet, and the universe as a whole would truly be our ultimate technological achievement.

A Promise Of Things To Come—*The Video Guide*—Volume 2

The process of extracting your own production idea from the etherealcosmos and materializing it through the magic of the video camera and a VTR is something very exciting. The production process, all its multitudinous components and factors, and how to successfully organize people and equipment is what *The Video Guide*, Volume 2, is all about.

"From The Abstract To The Real"—A brief outline:

Volume 2 will cover **AUDIO**, the importance of good sound, how to select microphones, and how to use the various audio voice over and music recording procedures effectively. **LIGHTING** will examine proper lighting methods, when to light, how to figure power requirements, and the use of various lighting instruments to create mood effects. There will be a chapter on television **GRAPHICS**, explaining the aspect ratio and essential graphic area. Graphic techniques will be explored, and the use of slides, films, and other visual inputs will be considered.

On the technical side, we will get into the **TV SCANNING SYSTEM** in detail—internal and external sync, and how to operate an oscilloscope and check your video and pedestal levels; but don't worry, you don't have to be an engineer.

We will discuss **SWITCHERS, SEG's** and **STUDIOS**. We will also see how they work, what kinds are available, what special effects are possible, how to set up a multiple camera system, and how to design a good studio and control room. This chapter will also cover production esthetics.

The main emphasis in Volume 2 will be on video **PRODUCTION**. But first, we will explore the planning and scripting process, how to get your idea on paper, and how to plan your equipment and crew needs. The production chapter will include sample photo releases, equipment lists, and detail the fine art of directing and selecting talent. We will also go into production economics, working with the shooting environment, and anticipating major and minor catastrophies. We will look at **CAMERA TECHNIQUE** and audio recording from a technical and esthetic point of view.

The **POST PRODUCTION** and **EDITING** process will receive much discussion including scene logging, edit scripting, various editing methods, and how to plan your production in order to make editing easier.

As well as the esthetic side of editing, we will examine the levels of editing hardware and how to use the equipment effectively. Manual backspacing editing methods are discussed using the AV-8650 and NV-3160 ½-inch EIAJ color editors. The pulse-counting editing systems such as the TRI, Convergence, and Sony VO-2860/RM-430 are examined, and a detailed operational analysis of the CMX and Datatron **COMPUTER EDITING** Systems will really give you a thorough understanding of the various possibilities afforded by editing hardware. Methods of **AUDIO DUBBING, IMAGE PROCESSING TECHNIQUES**, and **TIME BASE CORRECTION** will be examined in detail.

The hows and wheres of **TAPE DUPLICATION** and **TRANSFER TO OTHER MEDIA** plus an insightful chapter on various options for **GETTING INTO VIDEO PROFESSIONALLY** are included. The final chapter, **VIDEO AND THE FUTURE** will look into lasers, satellites, video art, computer video and **BEYOND VIDEO . . . .**

The Video Guide–Volume 2–"From the Abstract To The Real." should be available by the fall of 1980.

GLOSSARY

AAE Automatic Assemble Editing.

AC Alternating Current. Standard 120 V 60 cycle (Hz) USA household current. Also called LINE VOLTAGE. VTRs and cameras often use the 60 Hz as a horizontal sync reference.

AEF Automatic Edit Function. An automatic assemble editing feature found on JVC and Panasonic ¾-inch portable VCRs.

AGC *See Automatic Gain Control.*

ALIGNMENT TAPE A special manufacturer's tape containing picture and sound reference signals to use in aligning a VTR.

ALTERNATIVE TV Non-conventional TV programs and production processes.

APC Automatic Phase Control.

APERTURE The lens opening, F. stop or iris which determines the amount of light that enters the camera.

APERTURE GRILL A screen-like feature of Sony Trinitron TV sets which controls the amount of electrons that hit the phosphor coating of the TV screen.

ASSEMBLE EDITING "Add Editing." A new video or audio sequence that is consecutively added to a previously edited scene.

ATTENUATE Reduction of sound or picture levels.

AUDIO Sound portion.

AUDIO CUE A sound that is used to "tag" or denote an upcoming production event.

AUDIO DUB The recording of sound only, without disturbing the picture.

AUDIO HEAD A magnetic recording head that records or plays back sound.

AUDIO IN Audio input jack.

AUDIO MIXER A device that allows the simultaneous combining and blending of several sound inputs into one or two outputs.

AUDIO OUT Audio output jack.

AUDIO TRACK The portion of the videotape that stores the sound.

AUTOMATIC GAIN CONTROL An automatic circuit that controls the audio or video intensity during recording.

ALC Automatic *Level* Control (same as AGC).

ALC Automatic *Light* Control. A circuit in the camera which automatically compensates for changes in light intensity.

AUTOMATIC SCAN TRACKING (AST) A system used by Ampex 1-inch VTRs to insure perfect tracking.

AUXILARY IN Audio line input (non-microphone).

AUXILARY OUT Audio line output (non-microphone).

AVAILABLE LIGHT The amount of light normally present in the environment.

AZIMUTH The angle of a particular recording head.

— B —

BACK LIGHT The light that is present behind the image to be photographed. Can be used to create depth or it can cause severe silhouetting.

B&W Black and White.

BEAM The flow of electrons in the camera or TV tube.

BEAM SPLITTER PRISM A device used in color cameras to separate the red, blue, and green wavelengths.

BETAMAX Sony 1-hour ½-inch videocassette recorder.

BETA-2 Sony 2-hour ½-inch videocassette recorder.

BLACK Horizontal and vertical sync information without picture information.

BLACK LEVEL The bottom portion of the video waveform that contains the sync, blanking, and control signals.

BLANKING The time during which the TV scanning beam is turned off and is in the process of returning to scan another line on the TV or camera tube.

BOOM A long arm or device used to suspend a microphone or camera over the action.

BROADCAST TV A type of programming and bureaucracy that produces TV programs specifically for over-the-air broadcasting.

BURN A permanent image which persists in the same position on the target of the camera tube.

BURST Color burst. High-frequency pulses (3.5 MHz) that determine the phase of the color signal.

BUS A channel or coherent group of switches, inputs and controls.

— C —

CABLE TV Television signals transmitted primarily by cable instead of antennas.

CAMERA CHAIN *See Film Chain.*

CANNON CONNECTOR An audio plug, also called XLR plug.

CAPACITANCE An electronic circuit that stores a charge.

CAPSTAN A roller and rotating shaft in the VTR that is motor-driven and determines the speed at which the tape is moved through the VTR.

CAPSTAN SERVO A speed control system used in editing VTRs which assures clean edits by causing the editing VTR to reference to the playback VTR.

CARBON BACKED A type of videotape with a carbon backing.

CARDIOD A type of microphone that has a heart-shaped pickup pattern.

CATV Cable TV.

CCTV Closed Circuit Television. Any self-contained, non-broadcast TV system.

CHALNICON TUBE A cadmium selenide design camera tube used in broadcast TV cameras.

CHANNEL A specific band or frequency assigned to a radio or TV station.

CHROMA (CHROMINANCE) The hue or saturation (intensity) of color.

CU Close up.

CUE A warning or indication of an event that is about to take place.

CUE CHANNEL An audio track on the videotape that contains cueing information.

CUT Stop action or make an edit.

CHROMAKEY An electronic matte where one image is matted on top of another without image bleed-through (an electronic blindfold).

CHROMIUM DIOXIDE A magnetically-sensitive coating on videotape.

CLEAN EDIT A perfect undistorted transition from one scene to another.

CLIPPING A circuit that eliminates excessive variations in the video signal.

CMA ADAPTOR Sony camera adaptors.

C-MOUNT Standard screw-in 16 mm lens-mount found on most video cameras.

COAXIAL CABLE COAX. The standard single-ground, single-conductor cable which is used for most video connections. Technically referred to as 75 ohm Type RG-59U cable.

COBALT DOPED Magnetically sensitive coating on videotape.

COLOR BARS A series of colored bars or calibrated signal that is used as a reference for brightness, contrast, color intensity, and correct color balance. Usually generated electronically.

COLOR DISSECTOR TUBE A camera tube capable of separating an image into red, blue and green color values.

COLOR LOCK A circuit that stabilizes the color hues during playback.

COLOR PHASE The timing relationship of the color signal. The correct color phase will produce the correct color hues.

COLOR SUBCARRIER The 3.58 MHz carrier frequency that contains the color signal information.

COLOR SYNC The complete reference and control signal necessary to record and reproduce color--3.58 MHz (contains the color subcarrier also).

COLORIZER Device that produces electronically-generated color.

COMPOSITE SYNC The complete sync containing both horizontal and vertical sync signals.

COMPRESSION The elimination of excessive sound or picture elements that are either too high or too low. Produces a single sound or picture level.

CONDENSER MICROPHONE A high-quality microphone that uses condenser plates to produce sound. Condenser mikes contain built-in amplification and require batteries.

CONTRAST RATIO The degree of difference or ratio between the light and dark areas of the scene.

CONTROL TRACK The portion of the tape containing the speed control pulses.

CONTROL TRACK HEAD The head which records or plays back the control track pulses.

CONTROL TRACK PULSES Speed control pulses created by the VTR.

COMPATIBILITY The ability of one piece of equipment to interface with another (interchangeability).

COSMIC INTERFERENCE Influences generated from sources not normally perceived by the senses.

CRT Cathode Ray Tube. The vacuum tube used in all TV sets.

CROP The cutting off of picture elements by the camera framing.

CROSSTALK The undesirable interference created by one track on another.

CRYSTAL SYNC GENERATOR A high-quality sync generator.

– D –

db *See decibel.*

DC Direct Current. Electrical current that maintains a steady flow and does not alternate.

DC RESTORATION A circuit in a camera or VTR which restores the DC signal elements to the picture, resulting in good blacks.

DECIBEL A subjective measure of sound volume or strength.

DEFINITION The degree of detail or sharpness in a TV picture.

DEPTH OF FIELD The area of the picture between the closest and the farthest objects that are in focus--varies with the F stop.

DICHROIC MIRROR A mirror that reflects only certain wavelengths or colors and allows others to pass through it.

DIN *Deutsche Industrie-Norm.* German standard for plugs and connectors--4-Pin and 6-Pin plugs.

DIRECT COLOR PROCESS A method of color recording used by high-band broadcast VTRs whereby the color can be recorded directly.

DIRECTIONAL A narrow pickup pattern used by microphones.

DISSOLVE The gradual fading in of one picture while the other fades out.

DOLLY The movement of a camera toward or away from an object. Also the wheeled apparatus on which the camera is mounted.

DROPOUT A loss of picture signal during tape playback--displays as a black or white streak in the monitor.

DROPOUT COMPENSATOR (DOC). An electronic circuit that replaces a missing line of video information (dropout).

DUBBING The duplication of a videotape or the addition of new audio information to the tape.

– E –

ECU Extreme Close Up.

EDITING The process of putting into a predetermined sequence the various segments of master tapes.

EFP Electronic Field Production.

EIA Electronic Industries Association. The American TV standards committee.

EIA SYNC Also called EIA RS-170, the standard broadcast sync.

EIAJ The Electronic Industries Association of Japan. The Japanese standards committee which set standards for ½-inch helical scan videotape recorders.

EIAJ TYPE I The standard for ½-inch helical scan reel-to-reel VTRs manufactured after 1969.

EJ Electronic Journalism.

ELECTRONIC EDITING The process whereby a videotape is edited.

ELECTRON GUN The assembly inside the TV or camera tube which fires electrons at the face of the tube and performs the scanning process.

ELECTRET CONDENSER MICROPHONE A very sensitive microphone that requires a power supply in the microphone and needs a battery.

ELECTROSTATIC FOCUS A newer type of camera tube that is able to focus the electron beam without using heavy deflection coils.

ENCODING The combining of electronic elements.

ENG Electronic Newsgathering.

ERASE HEAD A magnetic head that erases electronic information on the tape.

E TO E Electronics to Electronics; a method of analyzing the output of a VTR relative to its input.

ETV Educational Television.

EXTENDED PLAY TAPES Tapes that are longer than usual.

– F –

FADE A gradual change in the picture or sound intensity.

FADE TO BLACK The picture is faded out until the screen is dark.

FERRITE A brittle, high frequency response material that is used to make video heads.

FIELD One half of a complete TV scanning cycle, or 262½ scanning lines; one half of a 525-line TV frame.

FILM CHAIN An optical system whereby an image from a film or slide projector is transferred to a video camera for use in a television system.

FIRST GENERATION The original recording or master tape.

FLAGGING Skew induced distortion produced at the top of the playback picture.

FLUID HEAD TRIPOD A tripod head that moves very smoothly.

FOCAL LENGTH The distance between the center of a lens and where the image is in focus, usually the image plane or the camera tube's target plate.

FOCUS COIL An electromagnetic coil that surrounds the camera tube and focuses the electron beam.

FOLLOW FOCUS The continual adjustment of a lens to keep the subject in focus when the subject and/or the lens are moving.

FOOTCANDLE FT-c; generally measured in LUMENS per square foot. The amount of illumination from 1 international candle falling on a 1-square-foot surface at a distance of 1 foot.

FORMAT A limited grouping of similar VTRs, such as in ½-inch and ¾-inch or small-format and large-format.

FRAME A complete TV picture of 525 horizontal lines which is composed of 2 scanned fields of 262½ lines each. One complete TV frame is scanned in 1/30th of a second.

FRAME RATE The speed at which the frames are scanned--30 frames a second for video.

FREQUENCY The number of times a signal vibrates per second.

FREQUENCY RESPONSE The ability of an electronic device to reproduce a wide range of frequencies.

F-STOP A calibration on the lens that indicates the width of the opening of the lens iris.

FLYING ERASE HEAD An extra video head which erases video information during the editing process.

– G –

GAIN The level of signal amplification.

GEL CELL A lead gelled acid battery.

GENERATION The number of copies away from the original.

GENLOCK The locking up of the sync generators of one or several sources to a main sync source; i.e., a VTR locked up to an SEG.

GLITCH Any picture distortion.

GRAY SCALE The various shades of gray in a TV picture which correspond to color.

GUARDBANDS The separations between the video tracks on the tape.

– H –

HEAD An electromagnetic device that records or retrieves information from magnetic tape.

HELICAL SCAN A helix-like method of recording video information on tape in which the signal is recorded diagonally in adjacent strips. Also called SLANT TRACK recording.

HERTZ (Hz) Cycles per second.

HETERODYNE COLOR PROCESS A method of reduction color recording used by small-format VTRs.

HIGH BAND A method or recording that utilizes very high frequency response characteristics--5 MHz-8 MHz.

HIGH DENSITY Videotape that packs more magnetic particles per square inch on the tape.

HIGH IMPEDANCE (HI-Z), 800-10,000 ohms. *See Impedance.*

HORIZONTAL RESOLUTION The number of vertical lines that can be perceived by a video camera in a horizontal direction on a test chart.

HORIZONTAL SYNC The sync pulses that control the horizontal scanning of the electron beam--generally 15.73 kHz.

HPF Hot Pressed Ferrite.

– I –

IC Integrated Circuit.

IMAGE ENHANCER An electronic device that sharpens the picture.

IMAGE PLANE The point at which the image is focused--generally at the camera tube target plate.

IMAGE RETENTION "Lag;" the tendency of the Vidicon tube to retain the image.

IMPEDANCE The resistance of a component to the flow of electrons--rated in ohms (Ω). Generally expressed as high impedance (hi-Z) or low impedance (low-Z).

INDEX ELECTRODE Part of the color derivation system used inside the Sony Trinicon tube.

INSERT EDIT The addition of new video and/or audio information into any point of a pre-existing video program.

INSTANT VIDEO CONFIDENCE A feature of IVC 1-inch VTRs that permits immediate tape monitoring.

INTERLACE The process of scanning whereby the alternate lines of both scanned fields fall evenly between each other.

INTERNAL INTELLIGENCE The inherent energy-bonding pattern present in all matter.

IPS Inches Per Second--Tape speed or writing speed.

IRIS The adjustable opening on the lens which controls the amount of light entering the camera.

– J –

JACK A plug or connector.

JOY STICK A lever that controls the position of a special effect on a screen, or the motion of tape on a VTR during the editing process.

– K –

KELVIN (K) The unit of measurement which denotes the temperature of light--expressed in °K.

KEYING The matteing of one picture over another.

KEY LIGHT The light used for primary illumination of a scene.

KILOHERZ (KHz) Thousand cycles.

KINESCOPE "Kine;" the process of recording a TV picture by photographing a TV set with a film camera.

– L –

LAG *See Image Retention.*

LAP DISSOLVE *See Dissolve.*

LARGE FORMAT Video equipment that uses very large videotape such as 2-inch.

LAVALIER MIKE A small microphone worn around the neck.

LED Light Emitting Diode.

LENS SPEED The ability of the lens to collect light. A "fast" lens collects more light than a "slow" one.

LEVEL The average intensity of an audio or video source.

LIGHT LEVEL The intensity of the light as measured in footcandles.

LIMITER An electronic circuit which adjusts or limits the audio or video intensity to a preset level.

LINE FREQUENCY The number of horizontal lines scanned in one second--15,750 lines or 15.7 kHz.

LINE IN An audio input for other VTRs or an audio mixer.

LINE LEVEL 600 ohms; a low inpedance signal.

LINE OUT Audio output.

LIP SYNC The process whereby the picture of a person's lips matches the sound of his voice.

LIVE The process of transmitting a program the instant it is taking place.

LOCK OUT LOGIC An electronic circuit which prevents the improper sequencing of controls.

LONG LENS A telephoto lens.

LONG SHOT A shot from a great distance.

LOW BAND A reduced frequency recording--less than 4 or 5 MHz.

LOW IMPEDANCE 30 to 600ohms--*see Impedance.*

LOW LIGHT Subdued illumination.

LUMEN *See Footcandle.*

LUMINANCE The photometric brightness or radiance of a light source.

LUX An old-fashioned measurement of light. One Ft-c =10.76 lux.

– M –

MACRO LENS A lens that is capable of close-up focusing.

MAGNETIC FOCUS-MAGNETIC DEFLECTION A tube-focusing design that requires external focusing coils.

MATCHING TRANSFORMER A device which changes the impedance of the audio or TV signal.

MATRIX An electronic circuit that is used to combine several electronic signals.

MATTE An effect or device which blocks out an adjacent signal or light.

MEDIUM SHOT The camera view between a close up and a long shot.

MEGAHERTZ (MHz) Million Hertz.

MICRON A unit of measurement used for denoting videotape width, 1MICRON= 25.4 MILs.

MIL A unit of measurement used for denoting videotape width, 1MIL= .001 inch.

MINI-PLUG A small audio plug, sometimes called a Sony plug.

MISTRACKING The picture distortion caused by improper tape-to-head or tape-path contact.

MIXED FIELD (MF). A method used by the Sony Trinicon color camera tube to derive color.

MIXER A device that combines and blends 2 or more audio or video sources.

MODULATION The process of adding video and audio signals to a predetermined carrier frequency.

MOIRE Herringbone interference patterns in a TV picture.

MONITOR A TV set without receiving circuitry that is used primarily to display video signals.

MONITOR/RECEIVER A dual function standard TV receiver and monitor.

MONOCHROME Black and white.

MULTIPLEXER A system of optics that allows simultaneous use of slide and film projectors as inputs for a video camera.

– N –

NEUTRAL DENSITY FILTER A filter that reduces the amount of light entering a camera without affecting the color.

NEWVICON TUBE A Panasonic camera tube which has very good sharpness and low light characteristics.

NI-CAD Nickel Cadmium battery.

NOISE Random undesirable picture or sound interference.

NON-COMPOSITE VIDEO SIGNAL A video signal that contains picture and blanking information only, no sync.

NON-SEGMENTED A system of recording that uses 1 head to scan 1 field of video information on the tape.

NTSC National TV System Committee--USA color TV standard.

– O –

OCTOPUS CABLE Multi-plug dubbing cable

OERSTEADS OF COERCIVITY The measurement of the ability of videotape to store information.

OMNI-DIRECTIONAL A microphone pickup pattern that is sensitive to sounds coming from all directions.

ONE LINE DELAY *See Drop Out Compensator.*

OSCILLOSCOPE An electronic test device that measures electronic signals. It is used for alignment of video equipment.

OUT Cessation of sound or music.

OXIDE The magnetic particles that are bonded on the tape.

– P –

PAL Phase Alternation Line--The British-German color TV standard.

PAN The movement of the camera horizontally.

PEAKS The highest level of signal strength.

PEDESTAL The blackest portions of the electronic picture.

PHASE The relative timing of one signal to another.

PHONE PLUG An audio plug with a ¼-inch wide connector shaft.

PHONO PLUG RCA audio plug.

PICKUP TUBE The electron tube in the camera or TV set.

PLUMBICON TUBE A high quality broadcast TV color camera tube manufactured by the Philips Company which features a lead oxide design.

POLARITY The positive and negative orientation of a signal.

PORTAPAK A portable video system.

POST PRODUCTION The editing phase of TV program production.

PRE-AMPLIFIER An electronic circuit which raises the signals high enough to be fed into an amplifier.

PRE-PRODUCTION Preparation activity that occurs prior to actual shooting.

PRE-ROLL The process of backing-up tapes and VTRs in preparation for an edit.

PROCESSING AMPLIFIER An electronic device which stabilizes and rebuilds signals.

PROGRAMMER An electronic control circuit or a computer used in conjunction with editing VCRs to facilitate precise editing.

PULSE CROSS DISPLAY The display of the edges of the TV image on a monitor.

PULSE DISTRIBUTION AMPLIFIER An amplifier that strengthens the sync, as well as other signals.

– Q –

QUADRUPLEX A video recording system that uses 4 video heads and scans the tape at a 90° angle.

QUARTZ LIGHTING Very bright and efficient lighting.

– R –

RACK MOUNTING The method of mounting equipment in a 19-inch wide standard metal rack.

RANDOM INTERLACE An unstable type of sync which allows the 2 scanning fields to fall randomly on top of each other.

RASTER The scanned or illuminated area of the TV picture tube.

RBG Red, Blue and Green or chrominance signal.

REGISTRATION The overlapping of the red, blue, and green signals to form a correctly colored image.

REMOTE Any program originating outside the studio.

RESOLUTION The amount of resolvable detail in a picture.

RETROFOCUS A lens with close-up focusing ability.

RF Radio Frequency; the range of frequencies used to transmit electric waves.

RF ADAPTOR A device that allows video and audio signals from a VTR to play back on a standard TV set.

RF AMPLIFIER An amplifier used for amplifying RF signals.

ROTARY ERASE HEAD *See Flying Erase Head.*

ROTARY TRANSFORMER A brushless method of transferring video signals from the rotating video heads to the VTR electronics.

RPM Revolutions Per Minute.

– S –

SATICON TUBE An arsenic tellurium design camera tube used in broadcast TV cameras.

SATURATION The intensity of the color.

SCANNER The video head drum.

SCANNING The horizontal and vertical movement of the electron beam in the camera or TV tube.

SECAM *Sequential Couleur a Memoire;* the French color TV system.

SECOND GENERATION *See Generation.*

SEG Special Effects Generator.

SEGMENTED SCAN RECORDING A system of recording that uses 1 video head to scan both fields of video information.

SEPARATE MESH A fine mesh screen located inside the Vidicon tube which helps control the target-area scanning.

SHADOW MASK A large screen containing half a million holes which helps focus the color electron beams inside a color TV set.

SHOOTING RATIO The amount of tape recorded relative to the amount of tape actually used.

SIGNAL Information transposed into electrical impulses.

SIGNAL READOUT ELECTRODES A device used inside the Sony Trinicon tube to derive the color signals.

SIGNAL-TO-NOISE RATIO The amount of visible "snow or noise" in a given picture relative to the actual picture signal. The *higher* the signal-to noise ratio, the better the picture.

SKEW The tape tension.

SKIP FIELD RECORDING A recording process whereby only one field is reproduced twice instead of reproducing both fields and interlacing them.

SLANT TRACK *See Helical Scan.*

SLIP RINGS Physical or mechanical means of transferring the video signal from the video head to the VTR electronics.

SMALL-FORMAT The small width videotape equipment such as ¼-inch, ½-inch, ¾-inch and 1-inch.

SMPTE The Society of Motion Picture and Television Engineers. A standards setting committee.

SOLENOID An electromagnetic circuit control system.

SOLID STATE Electronic circuitry that contains no vacuum tubes.

SPECIAL EFFECTS GENERATOR (SEG). A video-mixing device that allows switching between several cameras and a variety of special effects such as dissolves, fades, inserts, wipes, etc.

STRIPE FILTER A single color camera tube where sequential stripes on the face of the tube are used to derive the red, blue, and green and luminance signals.

SWITCHER A video switching and mixing device.

SYNC Synchronization; the timing pulses that drive the TV scanning system.

SYNC GENERATOR An electronic circuit which produces the sync pulses.

– T –

TALLY LIGHT An indicator lamp on the camera which shows when recording from the camera is being done.

TAPE CONFIGURATION Tape packaging.

TAPE PATH The path of the videotape past the heads.

TARGET The image forming area of the camera tube.

TEARING A picture condition when the image is displaced horizontally, usually caused by horizontal sync problems.

TELECINE *See Film Chain.*

TERMINATION The resistance or load that must occur at the end of a video signal--usually 75 ohms.

THIRD GENERATION 2 copies removed from the original tape.

TIGHT SHOT Close-up.

TIME BASE CORRECTOR A device that electronically corrects the mechanical and electronic errors created by a VTR.

TIME BASE STABILITY The degree of error or lack of error in sync pulse timing during VTR playback--generally caused by VTR mechanical irregularities.

TIME CODE The frame address code recorded on videotape.

TIME CODE GENERATOR An electronic device that creates a special address or time code to be recorded on the tape.

TIVICON TUBE A camera tube used for very low light shooting.

TRACKING The position of the video head over the recorded signal on the videotape.

TRINICON TUBE A Sony color tube which contains 3 color filters.

2:1 INTERLACE A method of scanning whereby both scanned fields are evenly spaced together.

TRUCK The lateral movement of the camera dolly.

– U –

UHF Ultra High Frequency; a connector used for video cables.

U-MATIC Sony trademark name which refers to the ¾-inch videocassette format VTRs.

UNDERSCAN The display of the entire TV image on a monitor.

UNI-DIRECTIONAL A selective microphone pick-up pattern.

– V –

VARIABLE FOCAL LENGTH LENS *See Zoom Lens.*

V-CORD II Sanyo 2-hour ½-inch videocassette recorder.

VCR Videocassette Recorder.

VERTICAL FREQUENCY The number of vertical fields scanned every second--60.

VERTICAL INTERVAL The time during which the VTR switches from one head to another and the picture is blanked out.

VERTICAL SYNC The sync pulses that control the vertical scanning of the TV picture--59.94 Hz.

VHF Very High Frequency.

VIDEO Picture information.

VIDEOCARTRIDGE A single reel closed loop of videotape in a self-contained plastic container.

VIDEOCASSETTE One reel of videotape and one empty reel in a closed plastic container.

VIDEODISC Video information recorded on a large round disc.

VIDEO DISTRIBUTION AMPLIFIER An amplifier that strengthens video signals.

VIDEO GAIN The amplitude of the video signal.

VIDEO IN A video input.

VIDEO OUT A video output.

VIDEO SWITCHER *See Switcher.*

VIDICON TUBE An inexpensive and versatile electronic pickup tube used in TV cameras.

VIGNETTING An effect produced by a lens when it fails to cover completely the camera tube image area.

VOICE OVER (VO). A spoken message or narrative added to the picture.

VPR Video Production Recorder; Ampex 1-inch VTR.

VU METER Volume Unit meter; measures audio levels.

VTR Video Tape Recorder.

– W –

WATT A unit of electrical power.

WAVEFORM MONITOR A special oscilloscope which is used to display the video signal.

WHITE BALANCE The video camera's ability to reproduce white correctly.

WHITE SET The adjustment of a color camera to correct white reference.

WIDE ANGLE LENS A lens with a very wide angle of view.

WIPE A special effect whereby one image "pushes" another image off the screen.

WRITING SPEED The resultant difference between the speed of the video heads and the speed of the videotape.

– Y –

Y The symbol for the luminance portion of a color signal.

– Z –

ZOOM LENS A lens that is capable of varying its focal length and serving as several lenses at once.

APPENDIX I

CABLE TV—PUBLIC ACCESS

Public Access (or a version of it) does live on and is growing slowly. It takes many forms, depending on the imagination and ingenuity of local media minded persons. Great potential exists in a new community where a cable system can be integrated into the whole community at once. Ground rules and expectations for public service programming should be negotiated in the beginning, so schools, town halls, city council chambers, and shopping centers can be wired 2-way, and everyone can ultimately participate in local issues and programming.

A regular grant or financial allotment could be set aside out of cable subscriber revenues to buy video equipment and pay salaries for production personnel. The money might go to a nonprofit citizen's group which could then parcel out the funds in the form of mini-grants to local groups and/or producers with good ideas for local TV programs. The community would probably start by funding a local access center with personnel and equipment to get the basic programming going.

INFORMATION SOURCES:

Information regarding the technical and organizational aspects of a Public Access CTV system is available from:

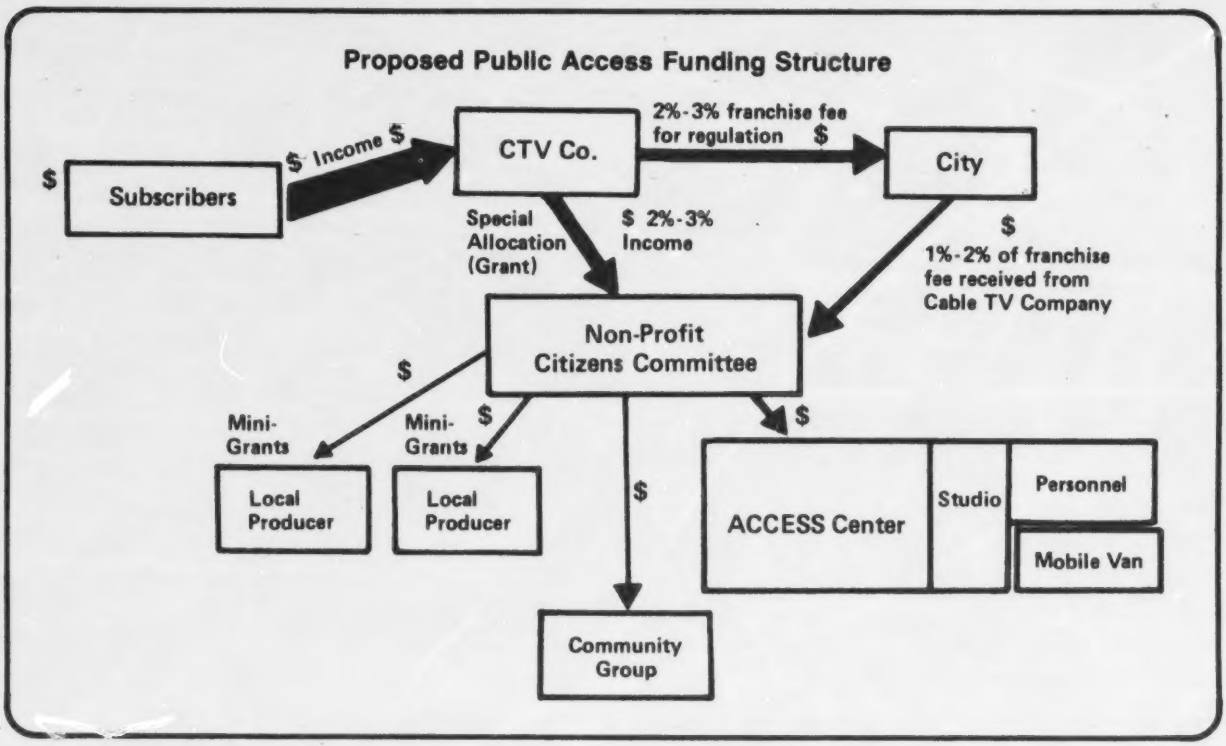
Tom Cross
Department of CATV
City of Boulder
Municipal Building
Boulder, Colorado 80302

The Cable TV Information Center
The Urban Institute
2100 M Street, N W
Washington, D.C. 20037

Other excellent source material on the politics and potential of Cable TV, Public Access, and Pay TV is available from:

The Aspen Institute
Program on Communication And Society
360 Bryant St.
Palo Alto, CA 94301

ACCESS Magazine
1346 Connecticut Ave N W Suite 415
Washington, D.C. 20036



PAY TV

PAY CABLE FACT SHEET

Pay cable programming is usually presented daily on pay cable channels and is often repeated during the week or month for viewers' convenience. The special programming can be delivered to the cable system in several ways. It can be originated at the cable system, or it can be fed to the cable system via terrestial microwave or even domestic communications satellite.

PAY CABLE SUBSCRIBERS 766,100

CABLE SUBSCRIBERS 12,500,000

CABLE SYSTEMS OFFERING PAY CABLE SERVICE. 253

TOTAL CABLE SYSTEMS. 3,487

NUMBER OF BASIC CABLE SUBSCRIBERS OF SYSTEMS OFFERING PAY CABLE 3,150,000

NUMBER OF STATES WHERE PAY CABLE IS IN OPERATION 42

TYPICAL PAY CABLE RATES . . . . . $7.59 per month (average)

NUMBER OF DOMESTIC SATELLITE GROUND STATIONS UTILIZED FOR PAY CABLE SERVICE. 49

National Cable Television Association
918 16th Street, N.W.
Washington, D.C.
202-457-6700

*All data as of 6/30/76

Here's a list of potential program buyers—so check them out!

APPENDIX II

VIDEO AND TELEVISION MAGAZINES:

BM/E (Broadcast Management Engineering)
274 Madison Ave.
New York, NY 10017

BROADCASTING MAGAZINE
Broadcasting Publications Inc.
Sales St., N.W.
Washington, DC 20036

CVRP PATCH PANEL
Calif. Video Resource Project
San Francisco Public Library
Civic Center,
San Francisco, CA 94102

EDUCATIONAL AND INDUSTRIAL TELEVISION
Also VIDEO TRADE NEWS and VIDEOPLAY REPORT
C.S. Tepfer Publishing Co
607 Main St.
Ridgefield, CT 06877

MEDIA AND METHODS
134 North 13th St.
Philadelphia, PA 19107

TELEVISIONS MAGAZINE
Washington Community Video Center
P.O. Box 21068
Washington, DC 20009

VIDEOCASSETTE AND CATV NEWSLETTER
Martin Roberts Associates
P.O. Box 5254
Beverly Hills, CA 90210

VIDEOGRAPHY
475 Park Ave. South
New York, NY 10016

VIDEO SYSTEMS MAGAZINE
1014 Wyandotte St.
Kansas City, MO 64105

PAY CABLE SUPPLIERS:

Associated Press
50 Rockefeller Plaza
New York, NY 10020

Bestvision, Inc.
5540 West Glendale
Suite C-160
Glendale, AZ 85301

Broadband
375 Park Avenue
New York, NY 10022

Cable Program Services
39 West 16th Street
New York, NY 10011

Cinemerica, Inc.
9477 Brighton Way
Beverly Hills, CA 90210

Hollywood Home Theatre
1345 Avenue of the Americas
New York, NY 10019

Home Box Office
Time and Life Building
Rockefeller Center
New York, NY 10020

Optical Systems
433 Airport Boulevard
Burlingame, CA 94010

Pay TV Services
3718 Woodsong Court
Dunwoody, Georgia 30338

Reuters
1700 Broadway
New York, NY 10019

Satori Productions
250 West 57th Street
Suite 2105
New York, NY 10019

Showtime
Viacom International, Inc.
345 Park Avenue
New York, NY 10022

Star Channel
Warner Cable Corporation
75 Rockefeller Plaza
New York, NY 10019

United Press International
220 East 42nd Street
New York, NY 10019

APPENDIX III

VIDEO PROGRAM SOURCES:

Program subjects cover the range from A to Z, and there are a variety of methods to get something to play on your VTR.

You can record programs off-the-air, but this can infringe on copyrights. Occasionally you may find some tape available on a free loan or free dub basis, or you can rent, lease, or purchase programs from a wide variety of program suppliers.

There are over 500 sources of prepackaged video programs and the number expands at the rate of about 20% annually. Most programming is available on ¾-inch "U," but some tapes are also available on 1-inch, 2-inch and ½-inch. Probably the bulk of programming will eventually shift to the ½-inch "B" and VHS format when these VCRs penetrate the home market.

The best way to find out what is available is to write to the suppliers for their catalogs. A growing number of independent producers are also making some very interesting and unconventional programming available. The following list is very incomplete, but will give you somewhere to start.

Academy Films, Inc.
P.O. Box 38753
Hollywood, CA 90038

Agency for Instructional Television
Box A
Bloomington, IN 47401

AIMS Instructional Media Services, Inc.
626 Justin Avenue
Glendale, CA 91201

Alternate Media Center
NYU School of the Arts
144 Bleeker Street
New York, NY 10012

Association for Educational Communications and Technology (AECT)
1201 16th Street, N.W.
Washington, D.C. 20036

Broadside Video
Elm at Millard
Johnson City, TN 37601

Cable Network TV
12636 Beatrice Street
Los Angeles, CA 90066

California Video Resource Project
S.F. Public Library – Civic Center
San Francisco, CA 94102

Campus Film Distributors Corp.
2 Overhill Road
Scarsdale, NY 10583

CitySlick c/o Tom Klinkowstein
106 Clarendon Street
Syracuse, NY 13210

Double Helix
390A North Euclid
St. Louis, MO 63108

Educational Resources Foundation
2627 Millwood Avenue,
P.O. Drawer L
Columbia, SC 29250

Electronic Arts Intermix
84 Fifth Avenue
New York, NY 10011

Electronic University
Box 361
Mill Valley, CA 94941

Encyclopaedia Britannica Educational Corporation
425 North Michigan Ave.
Chicago, IL 60611

Environmental Communications
62 Windward Avenue
Venice, CA 90291

Exec-U-Service Associates
P.O. Box 2214
Princeton, NJ 08540

Films for the Humanities,
P.O. Box 2053
Princeton, NJ 08540

Full Circle Media Archive
Box 4370
Boulder, CO 80302

Global Village Video Resource Center
454 Broome Street
New York, NY 10012

Golden Tape
341 Foothill Road
Beverly Hills, CA 90210

Great Plains National ITV Library
University of Nebraska
P.O. Box 80669
Lincoln, NE 68501

Index Video Exchange
P.O. Box 699
Port Townsend, WA 98368

Integrative Learning Systems, Inc.
326 West Chevy Chase Drive, No. 11
Glendale, CA 91204

Intercollegiate Video Clearing House
P.O. Drawer 33000R
Miami, FL 33133

Management Video Publications, Ltd.
Box 369, Toronto-Dominion Centre
Toronto, Ontario M5K 1K8
CANADA

Media Bus, Inc.
Maple Tree Farm
Lanesville, NY 12450

Media One
P.O. Box 1031
Belmont, CA 94002

Medical Educational Resources Program
Indiana University School of Medicine
1100 West Michigan Street
Indianapolis, IN 46202

Microcampus
206 Civil Engineering Bldg. No. 72
University of Arizona
Tucson, AZ 85721

National Audiovisual Center
GSA
Washington, D.C. 20409

Northeast Video and Sound, Inc.
287 Kenyon Street
Stratford, CT 06497

Public Service Video
New City School
Park Square Court
400 Sibley
St. Paul, MN 55101

Portable Channel
8 Prince Street
Rochester, NY 14607

Pyramid Films
P.O. Box 1048
Santa Monica, CA 90406

Readers Digest Television Division
200 Park Avenue
New York, NY 10017

Roundtable Films, Inc.
113 North San Vincente
Beverly Hills, CA 90211

Seton Hall University
Women and the Law (Distribution)
School of Law
1095 Raymond Blvd.
Newark, NJ 07102

Smith-Mattingly Productions, Ltd.
310 South Fairfax Street
Alexandria, VA 22314

Southern Educational Communications Association (SECA)
928 Woodrow Street
P.O. Box 5966
Columbia, SC 29250

Sports World Cinema
P.O. Box 17022
Salt Lake City, UT 84117

S/T Videocassette Duplicating Corp.
500 Willow Tree Road
Leonia, NJ 07605

The Humanist Alternative
923 Kensington Avenue
Buffalo, NY 14215

The Satellite Video Exchange Society
261 Powell Street
Vancouver, B.C. V6A 1G3
CANADA

Time-Life Multi-Media
Time-Life Bldg.
Rockefeller Center
New York, NY 10020

Turtle Island Media Endeavors
Box 4094
Aspen, CO 81611

TVTV
Box 48-455
Los Angeles, CA 90048

Varjradhatu
111 Pearl Street
Boulder, CO 80302

Videoplay Merchandising
333 West Lake Street
Chicago, IL 60606

Videotakes
P.O. Box 578
Cuba, NM 87013

Video Tape Network, Inc.
115 East 62nd Street
New York, NY 10021

Washington Community Video Center
P.O. Box 21068
Washington, D.C. 20009

William R. Ewald, Jr.
The Next Fifty Years
1730 K Street, N.W.
Washington, D.C. 20006

WNET 13 Media Services
356 West 58th Street
New York, NY 10019

Video Program Catalogs

Videologs
c/o Esselte Video
PO Box 978
Edison, NJ 08817

Addresses of Manufacturers:

APPENDIX IV

AKAI AMERICA LTD., 2139 East Del Amo Blvd., Compton, CA 90220

AMPEREX ELECTRONIC CORP., Electro-Optical Devices Div., Slatersville, RI 02876

AMPEX CORP., 401 Broadway, Redwood City, CA 94063

AMTRON CORP., P.O. Box 1150, Aptos, CA 95003

ANGENIEUX CORP. OF AMERICA, 1500 Ocean Ave., Bohemia, NY 11716

ARVIN INDUSTRIES/ECHO SCIENCE CORP., 485 East Middlefield Road, Mountain View, CA 94043

ASACA CORP., 1289 Rand Road, Des Plaines, IL 60016

BERKEY-COLORTRAN, 1015 Chestnut St., Burbank, CA 91502

CANON USA INC., 10 Nevada Drive, Lake Success, NY 11040

CMX SYSTEMS, 3303 Scott Blvd., Santa Clara, CA 95050

COMMERCIAL ELECTRONICS INC., (CEI), 880 Maude Ave., Mountain View, CA 94043

CONCORD COMMUNICATIONS SYSTEMS, 790 Park Ave., Huntington, NY 11743

CONRAC, BENJAMIN ELECTRONICS, 40 Smith Street, Farmingdale, NY 11735

CONSOLIDATED VIDEO SYSTEMS, (CVS), 3300 Edward Ave., Santa Clara, CA 95050

CONVERGENCE CORP., 17935 Sky Park Circle, Irvine, CA 92714

DATATRON INC., 1562 Reynolds Ave., Santa Ana, CA 92711

DIGITAL VIDEO SYSTEMS, 512 McNicoll Ave., Willowdale, Ontario, Canada

DYNASCIENCES VIDEO PRODUCTS, Township Line Road, Blue Bell, PA 19422

EIGEN CO., P.O. Box 1027, Grass Valley, CA 95945

FERNSEH GROUP, ROBERT BOSCH CORP., 279 Midland Ave., Saddle Brook, NJ 07662

FREZZOLINI ELECTRONICS INC., 7 Valley St., Hawthorne, NJ 07506

FUJINON OPTICAL INC., 672 White Plains Rd., Scarsdale, NY 10583

GBC CLOSED CIRCUIT CORP., 315 Hudson St., New York, NY 10013

HITACHI SHIBADEN CORP. OF AMERICA, 58-25 Brooklyn-Queens Expressway, Woodside, NY 11377

IKEGAMI ELECTRONICS INDUSTRIES INC. OF NEW YORK, 29-19 39th Ave., Long Island City, NY 11101

INTERNATIONAL VIDEO CORP. (IVC), 455 W. Maude Ave., Sunnyvale, CA 94086

JVC INDUSTRIES INC. 58-75 Queens Midtown Expressway, Maspeth, NY 11378

K & H PRODUCTS, LTD., Main St., North Benington, VT 05257

MAGNAVOX VIDEO SYSTEMS, 1700 Magnavox Way, Fort Wayne, IN 46804

MERLIN ENGINEERING WORKS, 1800 Embarcadero Road, Palo Alto, CA 94303

MICROTIME INC., 1280 Blue Hills Ave., Bloomfield, CT 06002

NIPPON ELECTRIC CO., LTD. (NEC America Inc.), 160 Martin Ln., Elk Grove Village, IL 60007

PANASONIC VIDEO SYSTEMS, Matsushita Electric Corp. of America, One Panasonic Way, Secaucus, NJ 07094

PHILIPS AUDIO VIDEO SYSTEMS, 91 McKee Drive, Mahwah, NJ 07430

RCA CORP. BROADCAST SYSTEMS, Front & Cooper St., Bldg. 2-5, Camden, NJ 08102

RANK PRECISION INDUSTRIES INC., 411 Jarvis Ave., Des Plaines, IL 60018

SANYO ELECTRIC INC., 1200 West Artesia Blvd., Compton, CA 90220

SENNHEISER ELECTRONICS, 10 West 37th St., New York, NY 10018

SHINTRON CO., 144 Rogers St., Cambridge, MA 02142

SHURE BROTHERS, 222 Hartley Ave., Evanston, IL 60204

SMITH-VICTOR CORP., Griffith, IN 46319

SPECTRA-VISION CORP., 1528 Belfield Ave., Philadelphia, PA 19141

SONY CORPORATION OF AMERICA, 9 West 57th St., New York, NY 10019

TELEMATION INC., P.O. Box 15068, Salt Lake City, Utah 84115

TELEVISION RESEARCH INTERNATIONAL (TRI), 1003 Elwell Court, Palo Alto, CA 94303

TENTEL, 50 Curtner Ave., Campbell, CA 95008

3M COMPANY, 3M Center, St. Paul, MN 55101

THOMSON-CSF LABORATORIES, 37 Brownhouse Road, Stamford, CT 06902

VIDEO AIDS CORP. OF COLORADO, 325 East Seventh St., Loveland, CO 80537

VIDEO ACCESSORIES CATALOGS:

COMPREHENSIVE VIDEO SUPPLY CORPORATION, 148 Veterans Dr., Northvale, NJ 07647

THE BILL DANIELS COMPANY, Markade Bldg, 6750 West 75th St., P.O. Box 2056, Shawnee Mission, KA 66201

WIDL VIDEO, 5325 North Lincoln Ave., Chicago, IL 60625

APPENDIX V

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Television Production: A Vocational Approach, by Richard L. Williams, Vision Co., Salt Lake City, Utah, 1976.

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Comment To The Reader

The Video Guide—Volume 1 is designed to anticipate the questions and needs of a broad range of video users. In order to update and improve *The Video Guide* in subsequent printings, any feedback regarding the usefulness of this publication is invited and welcomed by the author. Your comments can be addressed to Charles Bensinger, % Video-Info Publications.

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